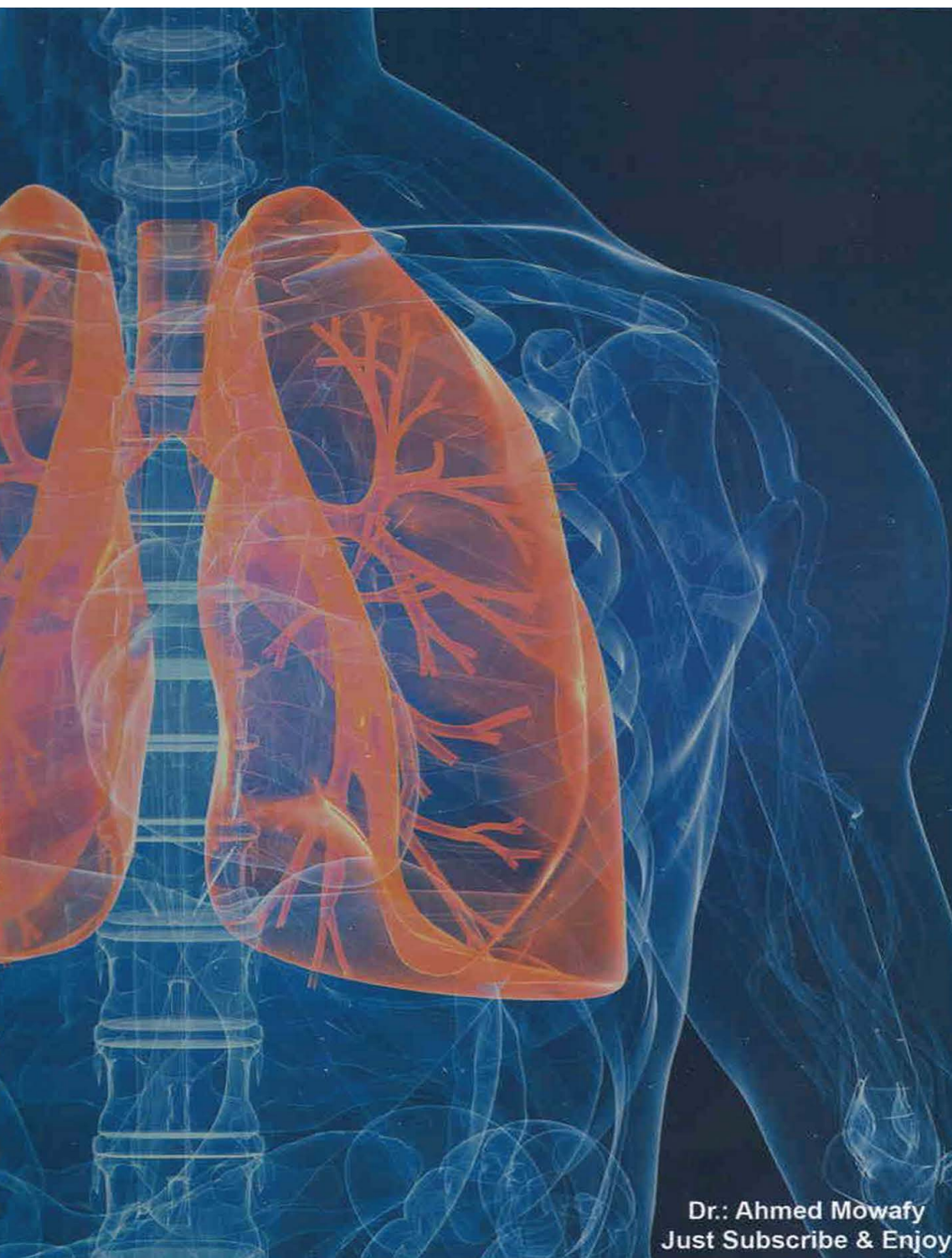


InCapsule | Series

SMARTER NOT HARDER

PULMONOLOGY



MOWAFY

Dr.: Ahmed Mowafy
Just Subscribe & Enjoy



INTERNAL MEDICINE

IRIS
ASPECT™

VISIT...

LANZAROTE
Caliente.COM



Dr.
AHMED
MOWAFY

SMARTER NOT HARDER

AVAILABLE BOOKS

Cardiology
Neurology
Nephrology
Gastroenterology
Endocrinology
Pulmonology
Rheumatology
Haematology

UPCOMING

ECG
Mowafy MCQ
Clinical Medicine

"Addiction-Free Nation Program should consider Incapsule Series it's 1st priority, as it has been proved that all Internal Medicine seekers are addicted to it"

"Studying Medicine without teacher is like sailing without a boat, and studying Internal Medicine without Dr. Ahmed Mowafy is like not going to the sea at all"

Dr. Alsayed Dawoud
Kasr-Alainy school of Medicine

"Ultimate Medicine experience, Internal Medicine impulse through the Mind".

Dr. Mohamad Rashed
Medical student, Artist

InCapsule **SERIES**

DESIGNED BY



University Book Centre
Sayed Mahmoud

103 Mathaf El Manial St. - Cairo

02-25329005 • 0101 111 7938 • 0115 720 6945

In Capsule Series

Internal medicine

Pulmonology

Dr. Ahmed Mowafy

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَا إِنْ
نَسِينَا أَوْ أَخْطَأْنَا رَبَّنَا وَلَا تَحْمِلْ عَلَيْنَا إَصْرًا كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِنْ قَبْلِنَا رَبَّنَا وَلَا
تَحْمِلْنَا مَا لَا طَاقَةَ لَنَا بِهِ وَاعْفُ عَنَّا وَاعْفِرْ لَنَا وَارْحَمْنَا أَنْتَ مَوْلَانَا فَانصُرْنَا عَلَى
الْقَوْمِ الْكَافِرِينَ

صدق الله العظيم

سورة البقرة (آية 286)

Preface

- *First and foremost, thanks are due to **ALLAH**, to whom I relate any success in achieving any work in my life.*
- *Great thanks to those who helped me, and greater thanks to those who try to break my wings as they make me more able to fly.*
- *My thanks are extended to all my medical students whom I produce this series "In Capsule Series" to obtain a higher degree in internal medicine by a simple effort.*
- *Finally, I wish to thank all members of My Family, my colleagues , my Friends and even all my patients for their continuous help, encouragement and support.*

Ahmed Mowafy

Index

Scheme	1
Surface anatomy	7
Pleural diseases	9
Pneumonia	20
Suppurative lung diseases.....	32
Acute bronchitis	45
COPD	46
Bronchial asthma	57
TB.....	71
Lung cancer	81
Smoking	91
Respiratory failure	93
Pulmonary fibrosis	97
Sarcoidosis	103
Lung collapse	106
Mediastinal syndrome	110
Diseases of chest wall	116
Diseases of diaphragm	118
Pulmonary hypertension	120
Pulmonary embolism	123
Cor pulmonale	128
Oxygen therapy	129
Mechanical ventilation	133
Dyspnea	135
Hemoptysis	138
ARDS	142
Chest collection	144
MCQ	157

CHEST SCHEME

Clinical picture :

Symptoms :

- 1- Asymptomatic.
- 2- General : FHMA (fever , headache , malaise , anorexia)
- 3- Cough.
- 4- Dyspnea.
- 5- Chest pain : due to pleurisy, chronic cough.

Plus

In suppurative lung diseases (e.g. Lung abscess , bronchiactasis) add..

- 1- Suppurative syndrome : Sputum with 5 criteria :

- Excessive .
- Foeted.
- Purulent.
- Paroxysmal.
- Positional :

⇒ Lung abscess : ↑ on left lateral position.

⇒ Bronchiactasis : ↑ on leaning forward.

- 2- Hemoptysis.

Signs :

General :

- 1-Fever.
- 2- Tachypnea.
- 3- Tachycardia.

Plus

- ✓ In pneumonia : add 3 colors.
- ✓ In Bronchiectasis : add 3 swellings.
- ✓ In COPD : swellings all over the body upside down.

Local :**Inspection :****i. Shape of chest :**

- Bulge : pleural effusion , emphysema , pneumothorax .
- Retraction : fibrosis , collapse.

ii. Respiratory movement : diminished on the affected side.**iii. Shallow respiration** in a case of pleurisy.**Palpation :** 3 T**1- Trachea :**

- Shifted to the opposite side : pleural effusion pneumothorax.
- Shifted to the same side : fibrosis , collapse.

2- Tactile Vocal Fremitus (TVF) : ↓↓ EXCEPT in : 3 C

- Consolidation (Pneumonia)
- Cavity (I mean superficial Pulmonary abscess)
- Collapse (Partial collapse)

3- Tenderness in a case of pleurisy.**Percussion :**

- Normal : resonant.
- Hyper-resonant : emphysema , pneumothorax.
- Tympanic : tension pneumothorax.
- Dullness : collapse , fibrosis , consolidation , pleural effusion ...
- Stony dullness : Massive pleural effusion.

Auscultation :

- 1- Breath sound.
- 2- Additional sound.
- 3- Special sound.

1- Breath sound :**i. Normal Vesicular breath sound :**

- ⇒ Inspiration : Expiration = 3 : 1
- ⇒ No gap.
- ⇒ Causes of diminished vesicular breathing : (Reduced conduction)
 - ✓ Obesity.
 - ✓ Pleural effusion.
 - ✓ Pneumothorax.

ii. Vesicular with prolonged expiration :

- ⇒ Inspiration : Expiration = 1 : 1
- ⇒ No gap
- ⇒ Causes : *In one word bronchial narrowing e.g.*
 - Chronic bronchitis.
 - Bronchial asthma
 - Bronchogenic carcinoma.

iii. Bronchial breath sound :

- There is a gap between the inspiration & expiration.
- Inspiration : Expiration = 1 : 1
- They are normally heard over the trachea and larynx.
- Causes : **3 C**
 - Consolidation
 - Cavity.
 - Collapse.

2- Additional sounds :**i. Pleural Rub :**

Caused by rubbing of inflamed pleural surfaces against lung tissue in a case of pleurisy.

ii. Rhonchi : narrowed airways e.g. Bronchitis , Bronchial asthma , ...

iii. **Crepitations** : (*Crackles, Rales*) e.g.

- Fluid in alveoli : Consolidations , pulmonary edema , ...
- Fibrosis.

3- **Special tests** : Post tussive suction in lung abscess.

Complications : Especially in :

- 1- *Pneumonia , lung abscess , bronchiactasis .*
- 2- *COPD.*
- 3- *Bronchial asthma.*

Complications of pneumonia , lung abscess & bronchiactasis :

a) **General** :

- Septicemia .
- Meningitis.
- Amyloidosis.
- DIC.
- MOF (multiple organ failure)

b) **Pleural** :

- Pleurisy.
- Pleural effusion.
- Empyema.

c) **Lung** :

- Pneumonia.
- Lung abscess
- Bronchiactasis.
- Fibrosis.
- ARDS

Plus

- ✓ In pneumonia ➡ add : unresolved pneumonia.
- ✓ In Bronchiactasis ➡ add : RF & Cor-pulmonale.

Complications of COPD : 11 (4,3,2,1,1)

- 4 Chest (infection , bronchiectasis , lung cancer , RF)
- 3 Cardiac (RSHF , LSHF, IHD)
- 2 Renal (Proteinuria , salt & water retention)
- 1 Stomach : peptic ulcer ☺
- Complications of chronic cough.

Complications of bronchial asthma : 6 see later**Investigations :****1- Radiology :**

- a) Chest X-ray :
 - i. Specific finding :☹
 - ii. Radiological signs of complications e.g. lung abscess
 - iii. Trachea : shifted to the same side in a case of fibrosis ☺
- b) CT.
- c) US : in a case of pleural effusion only.

2- Sputum examination :

- a) Culture & sensitivity test.
- b) **Microscopic analysis** : *to determine if the infection originates in the upper airways or lower airways* e.g. presence of macrophages, indicates that the specimen is from the lower respiratory tract.

3- Invasive method :

- Pleural aspiration.
- Transtracheal aspirate.
- Bronchoscopy with BAL (*bronchoalveolar lavage*)
- Open lung biopsy.

4- Blood examination :

- WBCs : Leukocytosis.
- Increased ESR.
- Serum electrolytes : hyponatremia in legionella. 🎵 🎵
- Renal & liver function tests.

5- Blood gases : e.g. hypoxia**6- ECG :** to exclude other cardiac causes of dyspnea.**Plus**

- ☒ In bronchial asthma & COPD : add pulmonary function tests .
 - i. Reduced FEV1 & FEV1/FVC %
 - ii. Bronchodilator test : usually FEV1 improve > 15 % after inhalation of short acting β_2 agonist in a case of bronchial asthma (unlike COPD, FEV1 response is < 15 %)
- ☒ Bronchiectasis :
 - CT has a high sensitivity & specificity.
 - Bronchography.
- ☒ TB : add tuberculin test.
- ☒ Pleural effusion : add pleural aspiration.
- ☒ Lung cancer : add investigations for metastasis.

SURFACE ANATOMY OF THE LUNG

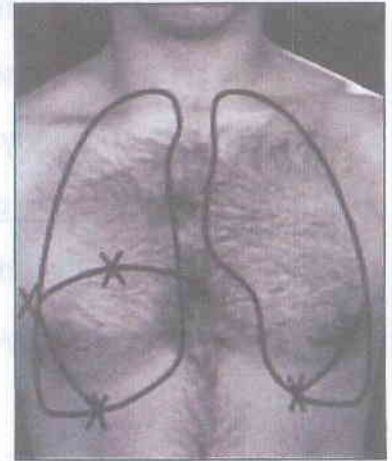
a) Apex :

Represented by curved line convex upwards, reaching 3 cm above the medial third of the clavicle.

b) Anterior border :

Represented by a line drawn downwards and medially from the sternoclavicular joint to the sternal angle near the midline, then :

- In the right lung : It extends vertically downwards to the 6th sternocostal junction.
- In the left lung : It extends vertically downwards to the level of the 4th costal cartilage, where it curves laterally for 3.5 cm and then downwards and medially to reach the 6th costal cartilage 4 cm from the midline.



c) Inferior border :

Represented by a line drawn laterally and backwards cutting the following ribs :

- 6th rib, at the midclavicular line.
- 8th rib, at the midaxillary line.
- 10th rib, at the scapular line.

d) Posterior border :

Represented by a vertical line drawn from the posterior end of the inferior border up to the apex of the lung.

NB

Surface anatomy of the pleura : the same as lung but add 2 ribs over inferior border of lungs. (Details : see pleural diseases)

Surface anatomy of lung lobes & fissures :

Right lung :

- The right lung is divided into 3 lobes (the superior, middle, and inferior lobes).
- The middle and inferior lobes are separated by the oblique fissure. This runs from the spinous process of the 2nd thoracic vertebra posteriorly to the 6th costal cartilage anteriorly.
- The horizontal fissure separates the superior and middle lobes. It runs from the point where the 4th rib crosses the oblique fissure and around to the 4th costal cartilage anteriorly.

Left lung :

- The left lung is divided into 2 lobes (the superior and inferior lobes).
- The two lobes are divided by the oblique fissure which follows the corresponding surface markings to those of the right oblique fissure.

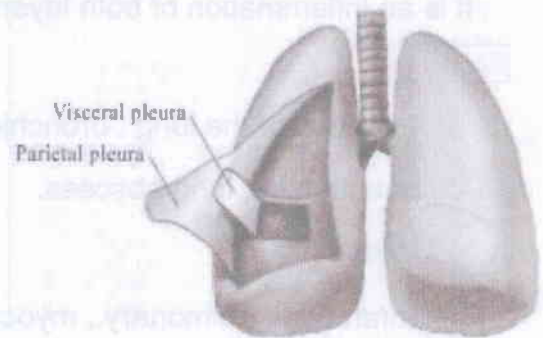
Numbers & borders : ☺

Borders	Mid-clavicular	Mid-axillary	Scapular
Liver (upper border)	5 th space	7 th space	9 th space
Lung (lower border)	6 th rib	8 th rib	10 th rib
Pleura (lower border)	8 th rib	10 th rib	12 th rib

PLEURAL DISEASES

Anatomy of the pleura :

- It is a serous membrane that cover the lung, it is composed of 2 layers : the inner one is called visceral pleura and the outer layer is the parietal pleura. There is a potential space which contain very small amount of fluid (10 – 20 ml) between these layers.



- Innervation of the pleura :

- Parietal pleura : supplied by both autonomic & somatic nerves (*phrenic & intercostals nerves*).
- Visceral pleura : supplied by autonomic nerves only , no pain fiber.

- Surface anatomy of the pleura : 2 4 6 8 10 12

Start by a curved line 2.5 cm above the medial third of clavicle → sternoclavicular junction → angle of Louis at midline (2nd rib) → from where it descends vertically downwards up to 4th rib then diverge (left more than right) → Right pleura is still parasternal at 6th rib → out & down to the lower border :

- 8th rib : in midclavicular line.
- 10th rib : in midaxillary line.
- 12th rib : in scapular line.

Mnemonic

Start 2.5 cm above medial third of clavicle then **2,4,6,8,10,12** ☺

2 nd rib	4 th rib	6 th rib	8 th rib	10 th rib	12 th rib
midline	midline	parasternal	midclavicular	midaxillary	scapular

Dry pleurisy

Definition :

It is an inflammation of both layers of the pleura without effusion.

Etiology :

- Infection of the lung : bronchiectasis (*the most common cause of recurrent pleurisy*) , pneumonia , lung abscess.
- Idiopathic.
- Infarction (pulmonary , myocardial infarction)
- Irradiation.
- Infiltration : tumor.
- Immunological : SLE , rheumatoid arthritis.

Clinical picture :

Symptoms :

- a) **Chest pain** (*pleurodynia*) : is due to stretch of the inflamed parital pleura.
 - Character : stitching or stabbing .
 - Increased by inspiration & movement.
 - Reduced by breath holding.
 - Reference :
 - ✓ To ipsilateral shoulder tip via *phrenic nerve* when area over central tendon of diaphragm is affected.
 - ✓ To upper abdomen via *lower intercostals nerves* when area over peripheral diaphragm is affected .
- b) Dry cough.
- c) Dyspnea. (due to the underlying cause or just false dyspnea due to pleuritic pain)
- d) Symptoms of the cause e.g. pneumonia.

Signs :

- a) **Pleural rub** : due to friction of the rough 2 layers of the pleura.
- b) Signs of the cause e.g. pneumonia

Investigations :

Investigations for the cause e.g. pneumonia.

Treatment :

- a) Analgesics for pain.
- b) Treatment of the cause.

Bornholm disease :

- Viral infection of the pleura caused by coxsackie B or echo viruses.
- It is self limiting disease.
- C/P : Upper respiratory tract infection followed by pleural pain lasts for about 1 week.
- Chest X ray : normal.
- Treatment : just symptomatic treatment.

Pleural effusion

Definition :

Accumulation of fluid in the pleural space more than the normal (10 – 20 ml).

Etiology :

I. Exudate : Any cause of pleurisy (Inflammation $\Rightarrow$ $\uparrow$ capillary permeability)

- **Infection :** The most common cause of exudative pleural effusion.
e.g. Pneumonia , lung abscess , TB , AIDS , Amebic liver abscess , ...
- **Infiltration (Tumor) :** Lung, breast, Lymphoma & Mesothelioma.
- **Infarction (Pulmonary & myocardial infarction)**
- **Immune :** SLE , Rheumatoid arthritis , Wegner's granulomatosis .
- **Irradiation.**
- **Iatrogenic :** amiodarone.

II. Transudate :

- Increased hydrostatic pressure : CHF, Pericardial effusion, pulmonary embolism
- Decreased capillary oncotic pressure : Nephrotic syndrome, liver cirrhosis & malnutrition.
- Obstructed lung lymphatics : lung transplantation.

III. Blood : Hemothorax in chest injuries, esophageal rupture.**Clinical picture :** It depends on :

- Rate of accumulation.
- Amount of the pleural fluid.
- Underlying cause.

Symptoms : scheme

- Asymptomatic : small amount or slowly accumulated.
- Chest pain : dull aching, stitching in inflammatory causes.
- Dyspnea.
- Cough.

Signs : (if pleural fluid > 500 ml)**Inspection :**

- Shape of chest : Unilateral bulge .
- Respiratory movement : diminished on the affected side.

Palpation : 3 T

- 1- Trachea & apex beat : Shifted to the opposite side.
- 2- Tactile Vocal Fremitus (TVF) : ↓
- 3- Tenderness in a case of pleurisy.

Percussion :

- Dullness to stony dullness over the affected area. (with the highest level in the axilla and lower levels in front and back "S-shaped curve of Ellis")
- **Skodiac sign :** hyperresonance in upper part of the lung above the effusion due to compensatory emphysema.

- **Grocco's triangle** (*paravertebral triangle*) : Triangular area of dullness at the back of chest on the opposite side of the effusion.

Auscultation :

1- Breath sound :

- Decreased or absent vesicular breath sound.
- Bronchial breath sound may be heard just above the upper border of effusion due to collapse (**Garland's triangle**)

2- Additional sounds : **Pleural Rub** : in a case of pleurisy.

In one word

Signs of pleural effusion : scheme + Skodiac sign , Garland's , Grocco's triangles

Doctor : Plz tell me what r the signs of pleural effusion ?

Student : No NoNo.....No....

Doctor : Whattttttttt ???????????????

Student : - Is there a respiratory movement ? No - Is there a TVF ? No
 - Is there an usual lung resonance ? No - Is there a vesicular breath sound ? No

So , don't blame me when I say 4 (No)s . This is called **syndrome of multiple -ve sign**

Doctor : I'm sorry , full mark.

ORAL EXAM



Investigations :

1- Radiology :

a) **Chest X-ray** : Pleural fluid > **250 ml**

i. Specific finding :

- Homogenous opacity obliterates the costophrenic angle, rising to axilla up to total opacification of an entire hemithorax in massive pleural effusion.
- Encysted pleural effusion : D- shape opacity.
- Fissural effusion : homogenous opacity at the site of the fissures.

ii. Radiological signs of cause e.g. lung abscess, pneumonia.

iii. **Trachea** : **shifted to the** opposite side.

b) **CT**: more reliable than X-ray for detecting effusion.

c) **US** : can detect up to 200 ml effusion.

2- Diagnostic aspiration :

I. Biochemical analysis :

a) To differentiate between exudate & transudate : "Light's criteria"

	Exudate	Transudate	
- Proteins	>	<	3 gm%
-Pleural fluid/serum protein	>	<	0.5
- Specific gravity	>	<	1016
- LDH	>	<	200 IU/L
- LDH(pleura)/LDH(serum)	>	<	0.6

b) Additional tests : **MCQ**

- PH of pleural fluid : < 7.2 with empyema. (N : equal to that of serum)
- Glucose : TB or cancer (low), Rheumatoid disease (dramatic low < 30 mg%)
- Amylase : ↑ in pancreatitis, esophageal rupture, malignancy.
- Lipids : milky fluid rich in fat in a case of chylous effusion.

II. Bacteriological examination :

Pleural fluid culture for aerobic, anaerobic & Ziehl Neelsen (ZN) for TB.

III. Cytological examination : For malignant cells , RBCs , WBCs ...

3- Sputum examination :

a) Culture & sensitivity test.

b) **Microscopic analysis** : to determine if the infection originates in the upper airways or lower airways.

4- **Pleural biopsy** : for malignancy, TB.

5- **Thoracoscopy**.

Treatment :

- Treatment of the cause : e.g. pneumonia , TB , lung abscess.
- Pleural aspiration to relieve dyspnea. (gradual under anesthesia)
- Pleuridesis : in a cases of recurrent effusion.
- Surgical lysis of adhesions may be required.

SPECIAL TYPES OF PLEURAL EFFUSION



1-Parapneumonic effusion	○ The most common cause of exudative pleural effusion is pneumonia. (40% of bacterial pneumonia is associated with pleural effusion) ○ It may progress to Empyema (...)
2- Tuberculous effusion	I. C/P : ○ Fever, malaise & recurrent dry pleurisy. ○ Pleural effusion & pleural fibrosis may follow. ○ TB empyema characterized by adhesions & calcifications. ○ Followed by active pulmonary TB. II. Investigations : ○ Culture of pleural fluid is often negative, pleural biopsy is diagnostic & show tuberculous granuloma in $\frac{2}{3}$ of patients. III. Treatment : ○ Chemotherapy alone is inadequate due to poor penetration of anti-TB drugs, so must be drained by ICT & surgical removal of a calcified empyema is necessary.
3- Empyema ○ Parapneumonic effusion is a noninfected effusion. ○ Empyema is a complicated parapneumonic effusion which means the pleural effusion is infected.	Definition : Presence of pus in the pleural space. Causes : Pneumonia, Lung abscess, TB Clinical picture : ○ General manifestations of toxemia. ○ C/P of pleural effusion. ○ May complicated by suppurative syndrome (<i>empyema with bronchopleural fistula</i>) : connection between pleura & bronchus $\Rightarrow$ cough with expectoration. Diagnostic aspiration : ○ PH : < 6.8 ○ Glucose : Less than serum level Treatment : Antibiotics , ICT drainage.
4- Malignant pleural effusion	○ Mostly due to pleural metastasis , rarely due to primary pleural tumor. ○ Diagnostic aspiration : bloody , positive results on cytologic examination. ○ Recur after aspiration.

5- Hemothorax	- Presence of significant amount of blood in pleural space. - Etiology : - o Chest trauma. - o Iatrogenic : Central venous catheter. - o Malignant pleural effusion. - Treatment : ICT drainage.
6- Chylothorax	- o Presence of chyle in the pleural space. - o Causes : injury of thoracic duct e.g. Trauma , Tumor as lymphoma , Idiopathic. - o Treatment : ICT , Surgery , Chemotherapy .
7- Rheumatoid effusion	- o Secondary empyema common. - o High LDH, low complement, high rheumatoid factor. - o Pleural fluid glucose < 30 mg% - o Cholesterol crystals are characteristic.

Pneumothorax

Definition : Presence of air in the pleural space.

Etiological types :

I. Spontaneous :

a) Primary :

- o Occurs in the absence of an underlying lung disease.
- o Mainly in tall young patients. It is thought to occur from rupture of subpleural apical blebs in response to high negative intrapleural pressures.
- o Family history and cigarette smoking may be important factors.

b) Secondary : is a complication of preexisting pulmonary disease e.g.

- o **A**irway diseases : COPD, severe bronchial asthma.
- o **I**nterstitial lung diseases : Sarcoidosis, interstitial pulmonary fibrosis.
- o **R**upture of subpleural TB cavity or lung abscess.

II. Traumatic :

- a) Iatrogenic pneumothorax : may follow procedures such as thoracentesis, pleural biopsy, rigid bronchoscopy and mechanical ventilation.
- b) penetrating or blunt trauma.

Pathological types :**I. CLOSED PNEUMOTHORAX :**

- Air in the pleural space with no communication with the atmosphere e.g. due to rupture bleb.
- Mild increase in pleural pressure , it resolves spontaneously as air is absorbed from the pleural space.

II. OPEN PNEUMOTHORAX :

- Air in the pleural space with communication with the atmosphere e.g. trauma.
- Inspiration allows air to enter the pleural space & expiration allows air to go outside the pleura to bronchus. So, there is mild compression on the lung.

III. TENSION PNEUMOTHORAX :

- It is a life threatening condition.
- The broncho-pleural fistula has ball valve (one way valve) effect allowing air to enter the pleural space during inspiration without escape during expiration
 ⇒ An increasing air in the pleural space develops over time ⇒ increasing intra-pleural pressure ⇒ compressing the lung & adjacent structures.

Clinical picture :

- Chest pain : Sharp unilateral pleural pain.
- Dyspnea : depends on the underlying lung disease & amount of air in pleural space (*marked dyspnea is present in tension pneumothorax*)
- Dry cough.
- Shock with tension pneumothorax.

I. GENERAL :

- Simple pneumothorax : tachycardia , tachypnea.
- Tension pneumothorax : Tachycardia, cyanosis, hypotension, respiratory distress.

II. LOCAL : *no signs in mild pneumothorax.***Inspection :**

- Shape of chest : Unilateral bulge .
- Respiratory movement : diminished on the affected side.

Palpation :

- i. **Trachea** : Shifted to the opposite side especially in tension pneumothorax.
- ii. **Tactile Vocal Fremitus** (TVF) : ↓

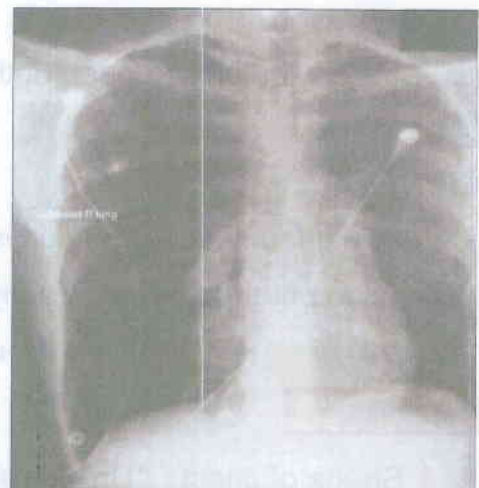
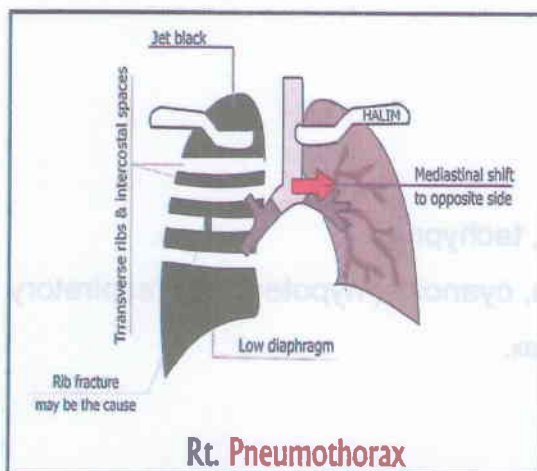
Percussion :

- Hyperresonance on the affected side.
- Tympanic in tension pneumothorax.

Auscultation : Decreased or absent vesicular breath sound.

Investigations :**1- Radiology :****a) Chest X-ray :**

- Distinct visceral pleural line & absence of lung markings outside this line (Jet black)
- Collapsed lung.
- Depressed copula of diaphragm.
- The costophrenic angle is abnormally deepened when the pleural air collects laterally, producing the deep sulcus sign.
- Mediastinal shift to the opposite side.
- Small pneumothorax may only be seen on an expiratory film.

b) CT.

2- Blood gases : e.g. hypoxemia & hypocapnia.

3- Pleural manometry :

- In closed type : pressure rises but remains negative.(< atmospheric)
- In open type : pressure oscillates around zero. (= atmospheric)
- In tension pneumothorax : pressure is progressively rising. (> atmospheric)

Deferential diagnosis :

Causes of acute dyspnea with acute chest pain : *see cardiology book p 104*

Treatment :

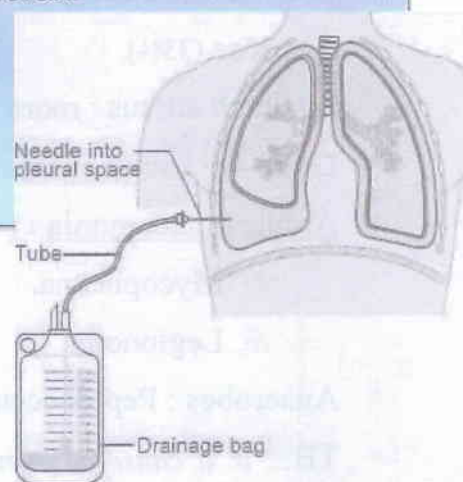
It depends on the severity of pneumothorax and the nature of the underlying disease.

- i. A small pneumothorax (< 20% of a hemithorax) often resolves spontaneously. Just symptomatic treatment.
- ii. Intercostal tube (ICT):

The chest tube is placed under water-seal drainage & suction is applied until the lung expands.

Indications of ICT in pneumothorax :

- ✓ Tension pneumothorax.
- ✓ Large pneumothorax > 20% of hemithorax.
- ✓ Recurrences of spontaneous pneumothorax.
- ✓ Bilateral pneumothorax.
- ✓ Patient on mechanical ventilation.
- ✓ Severe manifestations e.g. dyspnea.



Women tend to love men in their presence, while men tend to love women in their absence

PNEUMONIA

Definition:

Acute inflammation of the lung parenchyma (*distal lung*)

Classification :

- I. Anatomical classification.
- II. Etiological classification.
- III. Clinical classification.

I - Anatomical classification :

- a. Lobar pneumonia : involve one or two lobes.
- b. Segmental pneumonia : confined to a lung segment or segments.
- c. Subsegmental pneumonia.
- d. Bronchopneumonia : Patchy, multifocal & bilateral involvement. It usually follow bronchitis in contrast to lobar pneumonia which occur in previously healthy lung.

II - Etiological classification :

Infectious & noninfectious

Infectious pneumonia :

Bacterial :

- Gram +ve cocci :
 - Pneumococcal pneumonia (*streptococcus pneumonia*) : the commonest cause (35%)
 - Staph aureus : more common in old age & in immunocompromised patients.
- Gram -ve bacilli : Haemophilus influenza , E.coli , Pseudomonas , Klebsiella.
- Atypical pneumonia : (*caused by organisms devoid of cell wall*)

✦ Mycoplasma.	✦ Coxiella.
✦ Legionella.	✦ Chlamydia.
- Anaerobes : Peptococcus , Bacteroides.
- TB : is a cause of pneumonia; it is considered separately since both its mode of presentation and its treatment are very different from the other infective agents.

Non bacterial pneumonia :

- Viral : Influenza , Measles , EBV , CMV , Herpes simplex , coxsackie , Corona like (SARS) ..
- Fungal : Pneumocystitis carinii , histoplasmosis , aspergillosis , candida , ...
- Parasitic : toxoplasma ,

Non infectious causes :

- ✧ Chemical pneumonia : War gases or aspiration of oily material into the lung.
- ✧ Physical pneumonia : after radiotherapy of the chest.
- ✧ Collagen disease : Lupus pneumonia.

III. Clinical classification :

1- Community acquired pneumonia (CAP) : Pneumonia occurring in the community.

2- Hospital acquired pneumonia (HAP) : (Nosocomial pneumonia)

- ✧ Pneumonia occurring after 2 days of hospital admission.
- ✧ Etiology of HAP depends on :
 - Time of occurrence (Early or late onset)
 - Type of hospitalization (ICU or not , ventilated or not)
- ✧ Causative organisms :
 - Gram -ve bacilli e.g. pseudomonas , H.influenza , Klebsiella , ...
 - Staph aureus.
 - Atypical organisms e.g. Leigonella (which may present in air conditioning system)

NB : Over 90% of ICU acquired pneumonia occurring during mechanical ventilation .

Predisposing factors :

- Reduced or suppressed cough.
- Smoking & alcohol.
- Immunocompromised patients : renal failure , DM , ...
- Underlying lung disease e.g. COPD , bronchiectasis , bronchogenic carcinoma.
- Splenectomy.

Pathology : 4 Stages

- 1- Stage of congestion :** just congestion of the vessels without alveolar exudation.
- 2- Stage of red hepatization :** intra alveolar exudation especially with RBCs .
- 3- Stage of grey hepatization :** the exudation is mainly WBCs with minimal RBCs.
- 4- Stage of resolution :** the exudates is absorbed or removed by macrophages & proteolytic enzymes.

Clinical picture of lobar pneumonia :**Symptoms :**

- Acute onset of FHMA (Fever , Headache , Malaise , Anorexia).
- Cough :
 - Dry at first.
 - With brownish rusty sputum : during stage of red hepatization.
 - With watery sputum : during resolution.
- Dyspnea : which may be so severe.
- Chest pain : Pleuritic stitching pain due to pleurisy.

Signs :**I. General signs :**

- 1- Fever : with or without rigor.
- 2- Tachypnea & tachycardia : the RR to HR may be 1 : 2 (normal : 1 : 4)
- 3- Herpes labialis : herpes simplex infection of the lips especially in pneumococcal pneumonia.

MCO

Plus 3 colors

- 4- White → Pale toxic facies. (*flushing also may occur at first*)
- 5- Blue → Cyanosis may occur in severe cases.
- 6- Yellow → Jaundice : may occur due to hemolysis.

II. Local signs : *Clinical signs of consolidation.*

Inspection :

- Shape of chest : usually normal , unilateral bulge if pleural effusion is developed.
- Respiratory movement : diminished on the affected side.

Palpation :

- Trachea : usually central.
- TVF : increased over the affected lobe.

Percussion : dullness over the affected lobe.

Auscultation :

- Bronchial breathing over the affected lobe.
- Crepitations : fine late inspiratory crepitations at first (*stage of congestion*) then coarse inspiratory crepitations (*stages of hepatization & resolution*).

Indices of severe pneumonia :

- Tachypnea > 30 / min.
- Tachycardia > 125 / min
- Hypotension (BP $< 90/60$ mmHg).
- $\text{PaO}_2 < 60$ mmHg.
- $\text{PaCO}_2 > 50$ mmHg.
- Mental disturbance e.g. confusion.
- Evidence of renal insufficiency.
- Chest X ray shows more than one lobe involved or rapid progression.

Complications of pneumonia :

General :

- Septicemia & septic shock.
- DIC.
- **M**eningitis.
- **M**ultiple organ failure (MOF).

Pleural :

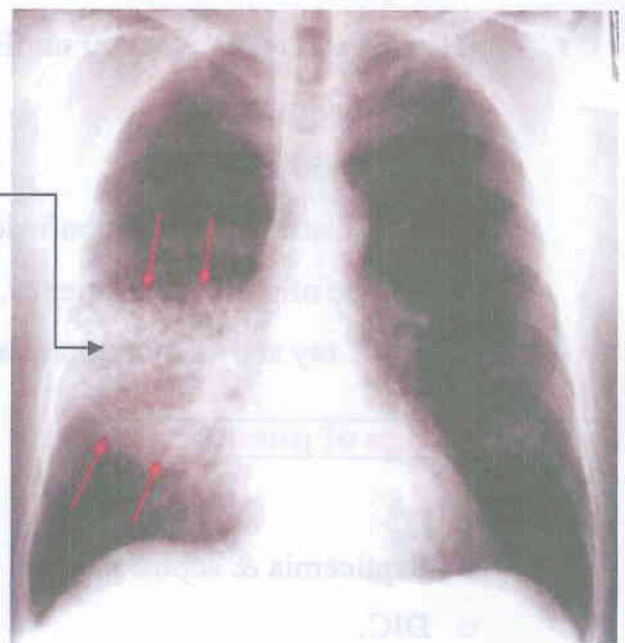
- Pleurisy.
- Pleural effusion.
- Empyema.

Lung :

- Lung abscess.
- Bronchiectasis.
- Respiratory failure in severe cases.
- **Unresolved pneumonia :**
 - Inadequate treatment.
 - Atypical organism.
 - Immunocompromised patient.
 - Underlying lung disease e.g. lung cancer.

Investigations : *after 12-18h of onset of symptoms***I. Chest X ray :** serial X ray is advised.

- Lobar pneumonia :
An area of **homogenous opacity**. It respects the lobar boundaries.
- Bronchopneumonia :
Patchy & bilateral shadows.
- Interstitial pneumonia e.g. viral :
reticular shadow.
- Radiological signs of complications :
e.g. lung abscess , pleural effusion.



II. Detection of the organism :

1- Sputum examination :

a. **Culture & sensitivity test** : Gram's stain & other special stains e.g. ZN for TB.

b. **Microscopic analysis** :

To determine if the infection originates in the upper airways (tracheobronchitis) or lower airways (pneumonia)

➤ **The squamous epithelial cells** : (that line the oral cavity)

In pneumonia, the count is less than 10 squamous epithelial cells/low-power field (x 100)

The presence of more than 25 cells/LPF (x100) indicates that the specimen is contaminated with mouth secretions.

➤ **Macrophages** : the home of macrophage is distal lung . so, the presence of macrophages regardless of the number , indicates that the specimen is from the lower respiratory tract.

➤ **Neutrophils** : > 25 cells/LPF (x100) can be used as evidence of infection.

2- Invasive methods :

- a. Pleural fluid culture.
- b. Transtracheal aspirate.
- c. Bronchoscopy with bronchoalveolar lavage (BAL)
- d. Open lung biopsy.

III. Blood examination :

- WBCs : Leukocytosis.
- Increased ESR.
- Serum electrolytes : hyponatremia in legionella
- Renal function tests.
- Liver function tests.
- Blood culture : pneumococci are detected in 30% of cases.



IV. Arterial blood gases : In severe pneumonia : PaO₂ is < 60 & paCO₂ > 50 mmHg.

Treatment of pneumonia :

I. Specific.

II. Supportive.

III. Symptomatic.

I. Specific treatment : Antibiotics.**A) Community acquired pneumonia (CAP) :****1- Mild to moderate CAP in young patients without co-morbidity :**benzyl penicillin 1-2 million U/6h IV. and if inadequate response add one of the following :

- ✗ Azithromycin.
- ✗ Augmentin (Amoxicillin clavunate)
- ✗ Ciprofloxacin.
- ✗ Cephalosporin (2nd generation- Cefaclor).

2- Mild to moderate CAP in young patients with co-morbidity or in elderly :**2 of the following :**

- ✗ Cephalosporin (2nd or 3rd generation)
- ✗ Augmentin (Amoxicillin clavunate)
- ✗ Azithromycin.

3- Severe ill-hospitalized patient with CAP :

- ✗ Azithromycin and one or two of the following anti-pseudomonal antibiotics :
- ✗ Ceftazidime (3rd generation cephalosporin)
- ✗ Piperacillin (antipseudomonas penicillin)
- ✗ Ciprofloxacin.

B) Hospital acquired pneumonia :**1- Non severe HAP : (colonization with Staph. aureus unlikely)**

○ Type of patient :

- Admitted less than 5 days ago.
- Without co-morbidity (heart , liver or renal failure).

○ Recommended antibiotic : one of the following

- ✗ Cephalosporin (2nd or 3rd generation)
- ✗ Ciprofloxacin.

2- Severe HAP: (colonization likely)

○ Type of patient :

- Admitted more than 5 days ago.
- With co-morbidity.

○ Recommended antibiotic : double or triple therapy for 2 - 3 weeks as follow :

✗ Piperacillin/tazobactam : 4.5 g / 6h. or

✗ Ceftazidime : 2g / 8h. or

✗ Imipenem (Tienem) : 1 g / 8h.

Plus

✗ Ciprofloxacin 400 mg/ 8h or

✗ Aminoglycosides (Gentamicin , Amkacin)

Plus

✗ Vancomycin if resistant staph aureus is suspected.

II. Supportive treatment :

- Fluid & electrolytes replacement.
- Total parenteral nutrition (TPN) in severe cases.
- Cardiac support : cortisone & dobutamine.
- Respiratory support :
 - Oxygen.
 - Mechanical ventilation is indicated when $O_2 < 60$ or $CO_2 > 50$ mmHg.

III. Symptomatic treatment : Analgesics & antipyretics.

Special types of pneumonia

1- Atypical pneumonia :

- Atypical pneumonia are generally caused by organisms devoid of cell walls and can't be detected on ordinary sputum staining and culture e.g.

- ✖ *Mycoplasma pneumonia.*
- ✖ *Legionella* (Legionnaire's disease).
- ✖ *Chlamydia pneumonia.*
- ✖ *Coxiella burnetii* (Q fever).
- ✖ Viral pneumonia.

Atypical pneumonia differs from that of classical pneumonia in the following points :

- 1) Marked general symptoms & signs e.g. fever, headache, malaise, confusion.
- 2) Mild local signs of consolidation : due to lack of alveolar exudate.
- 3) Extra-pulmonary symptoms : related to the causing organism.
- 4) Chest X-ray : may show bronchopneumonia (Patchy & bilateral shadows)
- 5) No responding on common antibiotics as sulfonamide and penicillin.

Mycoplasma pneumonia : (bacteria like organism without cell wall)

- Usually affects children & young adult.
- Incubation period : 2 – 3 weeks.
- There is a typically a longer general manifestations (fever, malaise, ...)
- Extrapulmonary manifestations :
 - ✓ CNS : meningitis, encephalitis, peripheral neuritis.
 - ✓ CVS : myocarditis, pericarditis.
 - ✓ Skin : erythema nodosum.
 - ✓ Hematological : autoimmune hemolytic anemia (cold type)
 - ✓ Skeletal : myalgia, arthralgia.

○ Investigations :

- Chest X-ray : marked patchy infiltration (interstitial pneumonia)
- CBC : normal WBCs.
- Cold agglutinins IgM : in 50% of cases.
- The diagnosis is confirmed by a rising mycoplasma antibodies titre.
- Sputum examination : normal.

○ Treatment :

- ✗ Erythromycin or other macrolides e.g. azithromycin, clarithromycin.
- ✗ Ciprofloxacin.
- ✗ Tetracycline is also effective.

Legionella pneumonia (Legionnaire's disease)

- Organism : G-ve cocco-bacilli.
- Usually related to contaminated water cooling systems, showers or air conditioning systems.
- Usually affects patients with underlying lung diseases.
- C/P :
 - Clinical picture of pneumonia.
 - Severe general manifestations e.g. fever (may exceed 40 °C).
 - GIT manifestations : nausea, vomiting, diarrhea.
 - CNS : Headache, confusion and delirium are prominent.
 - Acute renal failure may develop.
- Investigations :
 - CBC : Lymphopenia , pancytopenia may occur.
 - Hyponatremia : due to SIADH.
 - Chest X-ray : Patchy & bilateral shadows (bronchopneumonia)
 - Diagnosis is by serological tests.
- Treatment : rifampicin, clarithromycin or ciprofloxacin up to 21 days.

Viral pneumonia :

- Occurs mainly in immunocompromised patients.
- Influenza, parainfluenza, CMV, measles can cause pneumonia commonly complicated by bacterial infection.
- C/P : as atypical pneumonia.
- Treatment : antiviral & supportive measures.

2- Staphylococcal pneumonia :

- More common in extremes of age following viral infection of respiratory tract & in intravenous drug abusers.
- The infection starts in the bronchi, leading to patchy areas of consolidation in one or more lobes, which break down to form abscesses.
- C/P :
 - Clinical picture of severe pneumonia.
 - **Abscess** formation is frequent.
- Chest X-ray : may show lobar or more commonly bronchopneumonia with abscess formation in 25% & empyema in 10%.
- Treatment : ox , clox , diclox **acillin** . or vancomycin.

3- Klebsiella pneumonia :(*Friedlander's pneumonia*)

- Gram -ve bacilli which may produce lobar pneumonia.
- The upper lobes are more commonly affected.
- Cavitations may occur.
- Treatment : combination of cephalosporin & aminoglycoside.

DD of apical lung lesion :

- ✓ TB.
- ✓ Pancoast tumor.
- ✓ Bronchiectasis sicca hemorrhagica.
- ✓ Klebsiella pneumonia.

Aspiration pneumonia

- Pneumonia due to aspiration of gastric contents.
- Aspiration pneumonia may complicate impaired consciousness and dysphagia.
- Aspiration can cause lung inflammation (*chemical pneumonitis*) or infection (bacterial pneumonia or abscess) or airway obstruction.
- The most common presentation is tachypnea.
- Anaerobes are the principal organisms, arising from the oropharynx.
- Chest X-ray : shows an infiltration, frequently, in the dependent lung segments (*posterior basal segments of a lower lobe or the posterior segment of an upper lobe*).
- Treatment : metronidazole in combination with broad-spectrum agent (cephalosporin)

Pneumonia in Immunocompromised Patients

Immunocompromised patients develop pneumonia with usual organisms and with a number of organisms which don't normally cause pneumonia in healthy persons (opportunistic infection) e.g. *Pneumocystis carinii* (now *jirovecii*)

	Causes	Infecting organisms
Neutropenia	- Acute leukemia. - Cytotoxic drugs. - Agranulocytosis.	☠ <i>Staph. aureus.</i> ☠ Gram-negative bacteria. ☠ Fungi, e.g. <i>Candida albicans</i> and <i>Aspergillus fumigates</i>.
T cell defect (± B cell defect)	- HIV. - Lymphoma.	☠ Viruses : Cytomegalovirus, Herpesvirus, Adenovirus, Influenza. ☠ Fungi : <i>Pneumocystis carinii</i> (now <i>jirovecii</i>)
Defects in antibody production	- Multiple myeloma. - Chronic lymphocytic leukemia.	☠ <i>Hemophilus influenza.</i> ☠ <i>Mycoplasma pneumoniae</i>

SUPPURATIVE LUNG SYNDROME

Definition :

It is a syndrome characterized by cough & expectoration that is usually excessive , fetid , purulent , paroxysmal & related to posture.

It includes :

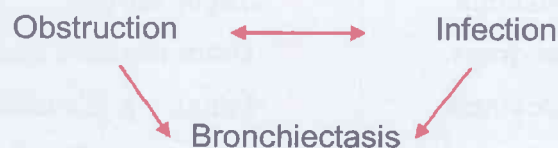
- 1- Bronchiectasis.
- 2- Lung abscess.
- 3- Infected cystic lung.
- 4- Empyema with bronchopleural fistula.

1- BRONCHIECTASIS

Definition :

- Persistent dilatation of terminal bronchi.
- *Bronchi & bronchioles normally become narrower as they go distally. If they maintain the same caliber or dilate as they go distally , the condition is called Bronchiectasis.*

Etiology :



I. Obstruction :

a) Congenital :

- Immotile cilia syndrome : Bronchiectasis , infertility , sinusitis .
- Kartagner's syndrome : Dextrocardia , Bronchiectasis , sinusitis

b) Acquired :

- From inside : foreign body aspiration.
- From the wall : Chronic bronchitis.
- From outside : Lymph node , tumor compression.

II. Infection :

a) **Congenital** : Congenital hypogammaglobulinemia (*recurrent infection*)

b) **Acquired** :

- TB.
- pneumonia.

Pathogenesis :

- Pulmonary infections → destroy the bronchial wall then dilatation.
- Bronchial obstruction → collapse & secondary infection → bronchial dilatation.

Pathology :

- i. Site : **B**ilateral , **B**asal , **P**atchy
- ii. Shape : Tubular , Fusiform , Saccular , Varicose (*tortuous*)
- iii. Inside the lumen : pus.
- iv. Outside : fibrosis.

Clinical picture :

Symptoms :

1- Suppurative syndrome :

- Excessive sputum . (> 100 ml/d)
- Foetid.
- Purulent.
- Paroxysmal. (*winter exacerbation*)
- Positional : **↑ on leaning forward**.

2- Hemoptysis : due to mucosal ulceration.

It is a common symptom & may be massive in advanced cases.

NB

Bronchiectasis sicca hemorrhagica :

Hemoptysis not associated with suppuration (*dry form*) , when the involved area is limited to the upper lobes e.g. post TB , Friedlander pneumonia.

- 3- General : FHMA (fever , headache , malaise , anorexia)
- 4- Cough.
- 5- Dyspnea.
- 6- Chest pain : due to pleurisy.
- 7- Sinusitis may be present in some cases.

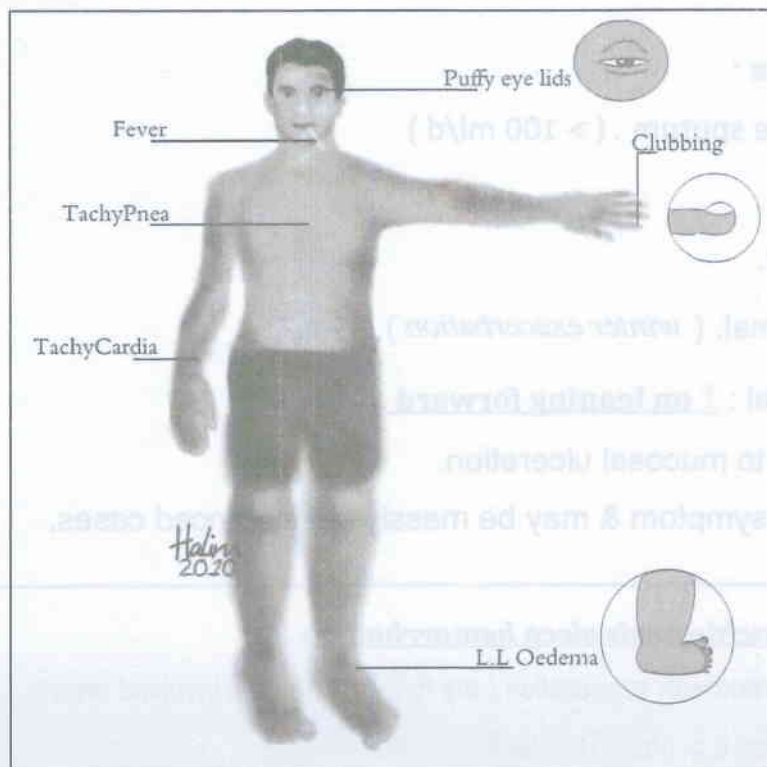
Signs :

General : 3 signs plus 3 swellings

- 1- Fever.
- 2- Tachypnea.
- 3- Tachycardia.

Plus 🐼

4. Puffy eyelid
5. Clubbing.
6. Edema lower limb.



Local : Like pneumonia but bilateral , basal , patchy

Inspection :

i. Shape of chest :

- Bulge : in a cases of pleural effusion , emphysema , pneumothorax.
- **Retraction** : in a case of fibrosis , collapse.

ii. Respiratory movement : diminished on the affected side.

Palpation :

1- Trachea :

- Shifted to the opposite side : pleural effusion .
- Shifted to the same side : fibrosis , collapse.

2- Tactile Vocal Fremitus (TVF) :

- ↑ on the basal part.
- ↓ in upper lung zone due to compensatory emphysema.

Percussion :

- Dullness on the affected site. (bilateral , basal)
- Hyper-resonance in upper lung zone (compensatory emphysema)

Auscultation :

1- Breath sound : Bronchial breath sound.

2- Additional sounds :

- Inspiratory crepitations at the affected site.
- Pleural Rub : in a case of pleurisy.

Complications :

a) General :

- ♦ Septicemia .
- ♦ Meningitis.
- ♦ Amyloidosis.
- ♦ DIC.
- ♦ MOF (*multiple organ failure*).

b) Pleural :

- Pleurisy.
- Empyema.
- Pleural effusion.

c) Lung :

- Pneumonia & Lung abscess.
- Fibrosis.
- ARDS
- **Respiratory failure & Cor-pulmonale** : in late stages of the disease.

Investigations :**1- Radiology :**

a) **Chest X-ray** : may be normal

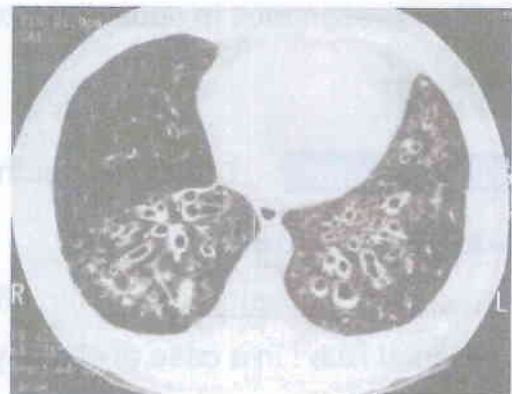
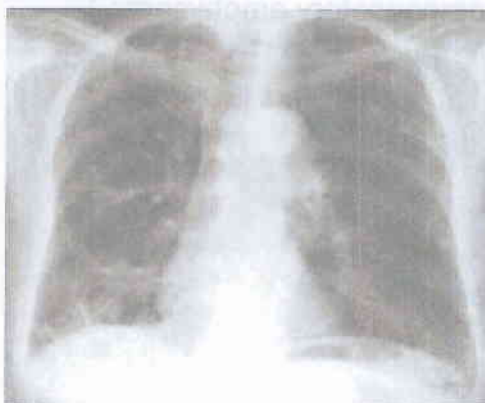
i. **Specific finding** : ☹

- **Honey comb appearance.**
- Soap - bubble appearance in cystic type.
- Tooth paste appearance : if the dilated bronchi are filled with secretions.
- Tram line appearance : Inflamed dilated but evacuated bronchi.

ii. Radiological signs of complications e.g. pneumonia , lung abscess

iii. Trachea : shifted to the same side in a case of fibrosis ☺

b) **CT chest** : has a high sensitivity & specificity in diagnosis of bronchiectasis.

**2- Sputum examination :**

a) Culture & sensitivity test.

b) **Microscopic analysis** : to determine if the infection originates in the upper airways or lower airways.

3- Invasive method :

- Bronchoscopy : assessing the cause & the site of hemoptysis.
- **Bronchography** : it is replaced by CT scan.

4- Blood examination : Leucocytosis.

5- Pulmonary function tests (PFTs) : may reveal obstructive or restrictive patterns.

6- Other investigations :

- ECG : dextrocardia in Kartagener's syndrome.
- Hypogammaglobulinemia.
- Investigations for immotile cilia syndrome : biopsies from the testis & bronchial mucosa , sweet test.
- Plain x-ray nasal sinuses : sinusitis or absent frontal sinuses.

Differential diagnosis :

- Other causes of suppurative lung diseases. *See later*
- Other causes of hemoptysis.

Treatment :

a) Prophylactic : Treatment of pneumonia or other chest infections as early as possible.

b) Therapeutic :

i. Medical : the main line of treatment A B C D

- ✗ **Antibiotics :** according to the culture & sensitivity.
- ✗ **Postural drainage :** very important in management of bronchiectasis.
- ✗ **Bronchodilators :** may be needed in cases of wheezes.
- ✗ **Symptomatic treatment :** e.g.
 - Hemostatic drugs in cases of hemoptysis.
 - Deodorant.
 - Expectorant.
 - Treatment of complications.
- ✗ **Diet :** high protein diet.

ii. Embolic therapy :

- Indicated in cases of massive hemoptysis to control bleeding.
- It is done by injecting sclerosing material in the feeding bronchial artery via aortic catheterization.

iii. Surgical : lobectomy or segmentectomy

Indicated in : Localized lesions with severe symptoms as massive hemoptysis.

2- LUNG ABSCESS

Definition :

Lung abscess is a localized area within the lung parenchyma, in which infection by pyogenic organism results in necrosis , suppuration & cavity formation.

Etiology :

a) Primary (Aspiration) lung abscess :

- i. Aspiration of an infected material from the oropharynx is the **most common cause**.
- ii. Absent cough reflex :
 - o Decreased conscious level : Anesthesia , Coma , epileptic fits.
 - o Defective swallowing : Bulbar palsy , Post operative , Reflux.

b) Secondary lung abscess :

- i. Pre-existing lung disease :
 - Pneumonia especially **Staph aureus** , **klebsiella** , **pseudomonas** , **Anaerobes**.
 - Bronchiectasis.
 - Bronchogenic carcinoma.
- ii. Sub diaphragmatic : Amebic liver abscess.
- iii. Hematological spread : from intra or extra – thoracic sites.

Pathogenesis :



1- Pneumonic stage :

Aspiration of infected oropharyngeal contents initially leads to pneumonia in dependent lung zones (*the right lung is more affected than the left because its bronchus is wider than the left & in line with the trachea*)

2- Stage of acute abscess :

Small zones of necrosis or microabscesses coalesce to form single or sometimes multiple areas of suppuration & when they reach a size > 1 cm in diameter they are called lung abscess leaving **cavity with irregular thin wall** that discharge into adjacent bronchus & so part of suppuration is expectorated.

3- Stage of chronic abscess : (> 6 weeks of proper treatment without healing)

- Cavity with regular & thick wall surrounded by fibrosis.
- The inner surface is covered with epithelial growth from the adjacent bronchus.

Clinical picture :**3 stages**

- I. STAGE OF PNEUMONIA.
- II. STAGE OF ACUTE ABSCESS.
- III. STAGE OF CHRONIC ABSCESS.

I. Stage of pneumonia : see pneumonia

II. Stage of acute abscess : (after about 1 – 2 weeks)

Symptoms :

scheme + suppurative syndrome + hemoptysis

1. Fever with rigor , headache , malaise , anorexia (FHMA)
2. **Suppurative syndrome** : cough & expectoration of ...
 - Excessive sputum . (> 100 ml/d)
 - Foetid.
 - Purulent.
 - Paroxysmal.
 - Positional : **↑ in left lateral position** (healthy side).
3. Hemoptysis may be occur and may be massive.
4. Cough.
5. Dyspnea.
6. Chest pain : it may be dull aching or pleuritic pain due to pleurisy.

Signs :

- General signs : Fever , tachypnea , tachycardia.
 - Local signs : signs of cavity
 - No signs in deep or small abscess.
 - The same as pneumonia (sorry , I don't repeat it again , just relax & see scheme)
- plus
- **Post tussive suction** : in a case of **acute** abscess.

III. Stage of chronic lung abscess :

Symptoms :

1. Deterioration of general health : loss of weight , anemia & clubbing.
2. Suppurative syndrome.
3. **Retention syndrome** : periods of no or mild expectoration with severe general manifestations (FHMA)

Signs :

Signs of Cavity **Plus** **fibrosis** :

- Unilateral chest retraction.
- Trachea may be shifted to the same side.

Complications :

The same as scheme

a) General :

- ◆ Septicemia .
- ◆ DIC.
- ◆ Meningitis.
- ◆ MOF (multiple organ failure).
- ◆ Amyloidosis.

b) Pleural :

- Pleurisy.
- Pleural effusion.
- Pneumothorax , empyema with or without bronchopleural fistula.

c) Lung :

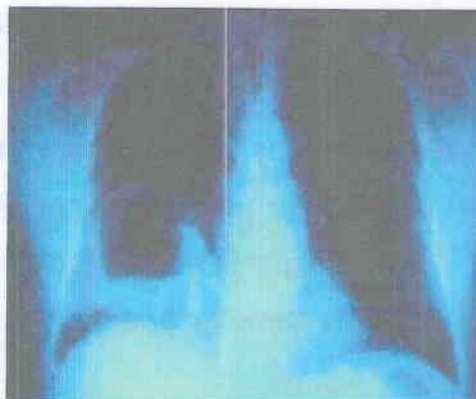
- Local spread to the same or to other lung.
- Pneumonia.
- Fibrosis.
- Bronchiectasis.
- ARDS.

Investigations :

1- Radiology :

a) Chest X-ray :

- Specific finding : ☹
 - A dense shadow is the initial finding before rupture.
 - Cavity with fluid level : the wall is thin in acute abscess , thick in chronic.



- ii. Radiological signs of complications e.g. pneumonia , pleural effusion.
- iii. Trachea : shifted to the same side in a case of fibrosis (chronic abscess) 😊

b) **CT chest** .

2- **Sputum examination** :

- Culture & sensitivity test.
- **Microscopic analysis** : to determine if the infection originates in the upper airways or lower airways.

3- **Bronchoscopy** :

- Diagnostic : to exclude malignancy , foreign body.
- Therapeutic : Aspiration of secretion , instillation of antibiotic , Foreign body extraction.

4- **Blood examination** : Leucocytosis , anemia.

Differential diagnosis :

From other causes of cavitary or suppurative syndrome : see later

Treatment :

a) **Prophylactic** : Treatment of pneumonia or other chest infections as early as possible.

b) **Therapeutic** :

i. **Medical** : the main line of treatment ABCD 😊

- **Antibiotics** : *Combined antibiotics to cover G+ve , G-ve & anaerobes* :
 - ✗ Penicillin G or third generation cephalosporin to affect G +ve organisms.
 - ✗ Aminoglycosides to affect G –ve organisms.
 - ✗ Metronidazole to affect the anaerobic organisms.
- **Postural drainage** : very important in management of lung abscess.
- **Bronchoscopy** : Aspiration of secretion , instillation of antibiotic , Foreign body extraction .
- **Symptomatic treatment** : e.g.
 - Hemostatic drugs in cases of hemoptysis.
 - Analgesics for pain.
 - Deodorant.
 - Expectorant.
 - Treatment of complications.

- Diet : good nutrition with high protein diet.

ii. Chronic lung abscess :

- Continue the medical treatment for another 6 weeks.
- Surgical treatment is indicated in :
 - Severe hemoptysis.
 - Failed medical treatment.



TVF examination 😊

3- Infected cystic lung

(Infected bronchial cysts)

Definition :

Developmental anomaly of the bronchial tree with abnormally dilated bronchial wall caliber with bronchial cyst formation.

Types :

- Central congenital cyst : usually solitary with no connection with bronchial tree.
- Peripheral congenital cyst : usually multiple & connected with bronchial tree.

Clinical picture :

- Age : usually child , sometimes adulthood.
- Asymptomatic : if no infection & no connection with bronchial tree (central type)
- Symptoms , signs & complications : similar to those found with lung abscess or bronchiectasis.

Investigations :

- Chest X- ray : soap bubbles appearance.
- CT chest.
- Sputum examination : culture & sensitivity.

Treatment :

- Medical : antibiotics & postural drainage.
- Surgical : in single central cyst or localized peripheral cysts.

4- Empyema with bronchopleural fistula

Definition :

Infected pleural fluid with fistula between pleural space & the bronchial tree.

Causes :

- Direct spread from adjacent pneumonia.
- Rupture of lung abscess into pleural space.
- Trauma.
- Invasion from subphrenic abscess e.g. amebic liver abscess.

Clinical picture :

- i. Clinical picture of the cause e.g. pneumonia.
- ii. Clinical picture of Empyema (*pus in pleura*)
- iii. Suppurative syndrome. (.....)

Investigations :

- Chest X- ray : hydropneumothorax.
- CT chest.
- Pleural aspiration : foul-smelling , culture & sensitivity , Low PH (<7.2) , White cells $> 15000/\text{mm}^3$.
- Methylene blue test : injection of methylene blue into pleural space $\Rightarrow$ bluish coloration of the sputum.

Treatment :

- Antibiotic therapy.
- Intercostal tube drainage.
- Surgical : pleuropneumectomy.

Acute bronchitis, tracheitis, and tracheobronchitis

- Inflammation due to infection can occur in any part of the tracheobronchial tree, and is termed tracheitis, tracheobronchitis, or bronchitis depending on the anatomical site.
- It usually follows viral infection, especially of the common cold type, and is commoner during influenza epidemics.
- Secondary bacterial infection is common, with *H. influenza* and *S. pneumonia*.
- **Clinical picture :**
 - o productive cough, small volume streaky hemoptysis, and fever.
 - o Breathlessness and hypoxia are uncommon unless there is coexistent cardiorespiratory disease, or a concomitant pneumonia.
 - o Retrosternal chest pain is common in tracheitis.
 - o Examination is often normal. There may be low pitched wheeze and coarse crackles that change with cough and they are due to secretion.
- **Diagnosis** is usually on the basis of the history. A persisting cough, especially in a smoker, may warrant further investigation.
- **Treatment** is usually symptomatic, particularly in the previously well. Use antibiotics for persistent cough productive of mucopurulent sputum, or if there is coexistent cardiopulmonary disease.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

Definition :

- COPD is a disease state characterized by the presence of airway obstruction due to **chronic bronchitis** and **emphysema**.
- The airflow limitation is usually progressive & not fully reversible.

Synonyms :

- ☞ Chronic Obstructive Airway Disease (COAD).
- ☞ Chronic Obstructive Lung Disease (COLD).

Chronic bronchitis :

It is a chronic disease of bronchial tree characterized by cough & expectoration daily for 3 successive months for **at least 2** successive years & not attributed to other pulmonary or cardiac causes. !!

Causes :

1. **Bronchial irritation :**
 - ☠ **Cigarette smoking** : the most common cause accounting for **> 90%** of cases.
 - ☠ **Air pollution** : car exhaust , industrial pollution
2. **Infections (viral & bacterial)** : aggravating factor.

Pathology :

1. **Simple chronic bronchitis :**
Hypertrophy of mucus glands → cough with whitish mucoid expectoration.
2. **Chronic obstructive bronchitis :**
 - There is organic narrowing & progressive decline in airflow.
 - It is due to :
 - Mucous gland hypertrophy.

- Infiltration of the walls of bronchi with inflammatory cells (neutrophils, CD8 + T lymphocytes).



In contrast , the cellular infiltration in case of bronchial asthma are mainly esinophils , CD4 + T lymphocytes) *MCQ*

- Inflammation is followed by scarring & remodeling process that thickens the walls of bronchi.

Emphysema :

- Defined as permanent dilatation & destruction of the lung distal to terminal bronchioles.
- **Causes :**
 - i. Emphysema associated with chronic bronchitis (the most common)
 - ii. α_1 - antitrypsin deficiency (Protease - antiprotease imbalance) :
Emphysema here is due to an imbalance between protease which digest elastin and other structural proteins in the alveolar wall and antiproteases which protect against this attack.
 - iii. Compensatory emphysema : as in cases of bronchiectasis , lobectomy.
 - iv. Senile (*atrophic emphysema*) : usually asymptomatic.
- **Pathology :** It is classified according to site of damage :
 - 1) Centri-acinar emphysema : is concentrated around the respiratory bronchioles (distal parts of acini are well preserved). It is associated with smoking.
 - 2) Pan-acinar emphysema : affects the whole acinus. It is associated with α_1 - antitrypsin deficiency.
 - 3) Irregular emphysema : affects the lung parenchyma patchy without respect for acinar structure.

Pathophysiology :

Usually patients with COPD show combination of emphysema & chronic bronchitis with predominance of certain feature over the other.

Type A : (Pink Puffer)

- This patient has dominant emphysema. (*Impaired diffusion*)
- There is hypoxemia with normal or low level of CO₂.
- This hypoxemia ⇒ Respiratory stimulation (*fighting for oxygen*) that will keep O₂ & CO₂ near normal levels so there are :

- a) Severely dyspnea (Puffer)
- b) No cyanosis (Pink)

Type B : (blue bloater)

- This patient has dominant chronic bronchitis. (*Impaired ventilation*).
- There is hypoxemia with hypercapnea.
- This patient is non-fighter for oxygen, so there are :
 - a) No dyspnea.
 - b) Cyanosis. (blue)
 - c) Cor pulmonale is common ⇒ edema (bloater)

If you don't understand anything OK

Type B : (type 2)

- ✓ Bronchitis is dominant
- ✓ Blue , Bloater.
- ✓ Type 2 : there are 2 things : hypoxia & hypercapnia. ☺

Type A : (type 1)

- ✓ Emphysema is dominant.
- ✓ Type 1 : there is 1 thing : hypoxia only without hypercapnia. ☺

Type A (Pink Puffer)	Type B (blue bloater)
Severe dyspnea with purse -lip breathing.	Mild dyspnea
Small sputum volume	Large sputum volume
Usually thin patient	Usually obese
No cyanosis	Cyanosis
No edema	Edema
<u>Investigation</u>	
Near normal blood gases.	Abnormal blood gases
Radiological evidence of emphysema.	No radiological evidence of emphysema.
Impaired transfer factor	No reduction in transfer factor.

Clinical picture :**Symptoms :**

- History of heavy smoking for many years.
- Cough : Often present on waking up at first, later on throughout the day.
- Productive cough :
 - Initially mucoid then purulent sputum with exacerbation of disease.
 - Often worse in winter months & after chest infection.
 - Often discounting by the patient as an expected consequence of smoking (*smoker's cough*)
 - Daily sputum production of 3 or more months in 2 successive years defines chronic bronchitis.
- Dyspnea :
 - It is slowly progressive over years.
 - Commonly the reason why patient seek medical attention.
- Wheezes that are usually persistent & continuous (*not in attacks as in bronchial asthma*)
- Weight loss & anorexia : in severe COPD.

Signs :**General signs :**

- 
1. No signs in mild cases.
 2. Tachypnea.
 3. Tachycardia & pulsus paradoxicus may be present.
 4. Puffy eye lid.
 5. Congested neck vein.
 6. Prominent accessory respiratory muscles in neck.
 7. An inspiratory tracheal tug : due to contraction of the low flat diaphragm.
 8. Elevated shoulders with professional attitude.
 9. Enlarged liver.
 10. Abdominal protuberance : due to low position of diaphragm with displacement of the abdominal contents.
 11. Edema lower limb.

NB

Clubbing is NOT a feature of COPD and suggests malignancy or bronchiectasis.

Local signs :**Inspection & palpation :**

- Increased A-P diameter of the chest (barrel shaped chest)
- Diminished chest expansion.
- Lower intercostals indrawing with inspiration.

Percussion :

Hyperresonance with loss of the normal cardiac and liver dullness.

Auscultations :

- Prolonged expiration.
- Rhonchi : throughout the chest.
- May be basal crepitations.

Complications :**Lung :**

- Recurrent chest infections.
- Bronchiectasis.
- Pneumothorax.
- Respiratory failure. (*see later*)

Heart :

- Right sided heart failure. (cor pulmonale)
- Left sided heart failure.
- Myocardial hypoxia can increase the risk of ischemic heart disease.

Renal :

- Salt & water retention : due to renal hypoxia.
- Proteinuria : due to renal congestion.

Stomach : Peptic ulcer.

Complications of chronic cough :

Rupture bullae , hernia , insomnia

Investigations :**1- Radiology :**

a) Chest X-ray : may be normal

i. Specific finding :

- May be normal in early stages.
- Hypertranslucency of the lungs with transverse ribs & wide intercostal spaces.
- Low flat diaphragm.
- Narrow elongated cardiac shadow (ribbon shaped heart).
- May be emphysematous bullae.
- Increased broncho-vascular marking.

ii. Radiological signs of complications e.g. pneumonia , bronchiectasis.

b) **CT chest** : diagnose early cases.

2- Pulmonary function tests *:

A) Spirometry :

- Decreased FEV1: < 80%
- Decreased FEV1/FVC ratio : < 70%
- FEV1 depends on disease stage.

Stage		FEV1 (%)	FEV1/FVC
0	At risk	> 80	N
1	Mild	> 80	< 70 %
2	Moderate	50 - 80	< 70 %
3	Severe	30 - 50	< 70 %
4	Very severe	< 30	< 70 %

B) **Bronchodilator test** : usually FEV1 improve < 15 % (unlike bronchial asthma FEV1 response is > 15 %)

C) Recently the inspiratory capacity (IC) is suggested to be a more sensitive than FEV1 as it correlates better with air trapping.

D) Gas transfer coefficient of CO is low in severe cases.

3- Blood changes :

- a) Hypoxemia with normal or low level of CO₂ in type A.
- b) Hypoxemia and hypercapnia in type B.
- c) Secondary polycythemia : due to chronic hypoxia.
- d) May be deficiency in α 1 antitrypsin . (N : 2 - 4 gm/L)

NB : Estimation of serum α 1 antitrypsin is indicated in any young patient less than 40 years with emphysema.

4- **ECG** : P-pulmonale , RVE in cor-pulmonale.

5- **Echocardiography** : to assess cardiac function.

Differential diagnosis :**1) Bronchial asthma :**

- Reversible airflow limitation.
- Onset early in life.
- Family history of asthma.
- Symptoms at night/early morning.
- Allergy, rhinitis and/or eczema.
- Bronchodilator test : FEV1 response is > 15 %

2) Congestive heart failure :

- Fine basal crepitations on auscultations.
- Chest X-ray : shows dilated heart , pulmonary edema.
- Pulmonary function tests : volume restriction, not airflow limitation.

3) Bronchiectasis :

- Large volumes of purulent sputum.
- Clubbing of fingers.
- Coarse crepitations on auscultation.
- Chest x-ray / CT : bronchial dilatation.

4) TB.

Clinical data	COPD	Bronchial asthma
Smoking history	+ve	Usually -ve
Course of the disease	progressive	Intermittent
Cough	Early morning	Night/early morning
Sputum	purulent	Not purulent
Dyspnea	All the time	Only in attacks
Central cyanosis	May be present	Absent (may be present in acute severe asthma)
Generalized wheezing	Common	In attacks
Peripheral edema	May be present	Not a feature
Spirometry : ↓ FEV1	Always	In attacks
Bronchodilator test	FEV1 improve < 15 %	FEV1 improve > 15 %
Response to cortisone	Poor	good

Treatment :**I. Prevention :**

- Smoking cessation : is vital even in late stage of the disease.
- Influenza and pneumococcal vaccination.

II. Drug therapy :**1) Bronchodilators :****a) Short acting bronchodilators :**

- ✗ Short acting β_2 agonists e.g. salbutamol
- ✗ Short acting anti-cholinergic agents e.g. ipratropium bromide

b) Long acting bronchodilators :

- ✗ Long acting β_2 agonists e.g. salmeterol : given twice daily by inhalation.
- ✗ Long acting anti-cholinergic agents (tiotropium bromide) : once daily

2) Thiophylline : can be given.**3) Corticosteroids :**

- Less benefit in COPD than in asthma
- It used in acute exacerbation of COPD or in patients with overlap with asthma (*asthmatic bronchitis*).

4) Antibiotics :

- Antibiotics should always be given in acute exacerbation.
- Amoxycillin or erythromycin may be given.
- New generation flouroquinolones (*levofloxacin*) & macrolides (*azithromycin*) can be more effective.

5) α_1 antitrypsin replacement :

Monthly infusion is indicated in patient with serum level < 310 mg/L and abnormal lung function.

III. Non pharmacological therapy :

1- Rehabilitation :

- Exercise.
- Diet : both over & under-weight can be a problem to COPD patients.

2- Long Term Oxygen Therapy : (LTOT)

- One of the principle non-pharmacological treatment for patients with stage III and IV.
- Oxygen via nasal cannulae is given to rise the PaO_2 to 60 mmHg for at least 15 hours per day.
- Long term oxygen therapy :
 - Increase survival.
 - Improve exercise capacity.
 - Improve lung mechanics.
 - Improve mental state.
 - Decrease pulmonary arterial pressure.

3- Surgical treatment :

- a) Bullectomy : removing of non functioning large bulla , so the adjacent lung parenchyma is decompressed.
- b) Lung reduction therapy.
- c) Lung transplantation.

Treatment according to staging :

- Stage 0 : Avoidance of risk factors , influenza vaccine.
- Stage I : Add short acting bronchodilator when needed.
- Stage II : Add regular treatment with one or more long acting bronchodilators.
- Stage III : Add inhaled corticosteroids if repeated exacerbation.
- Stage IV : Add long-term oxygen therapy, consider surgical treatment.



Treatment of acute exacerbation :

a) Antibiotics : if two of the following are present :

- Increased breathlessness.
- Increased sputum volume.
- Increased sputum purulence.

b) Bronchodilator (nebulized or inhaled).

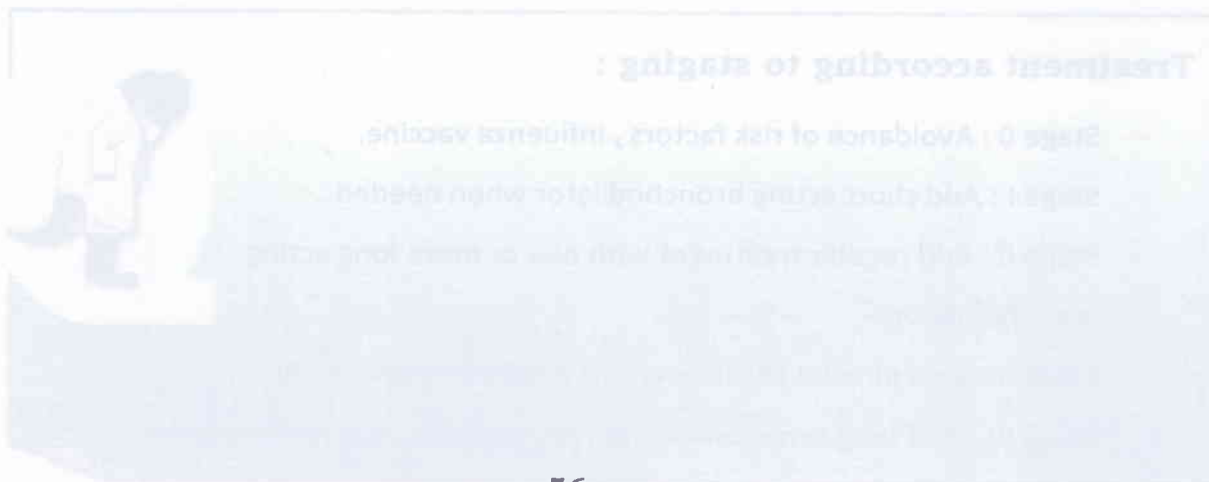
c) Short course of steroids.

d) Oxygen therapy.

e) Mechanical ventilation may be considered in some cases : *Non-invasive positive pressure ventilation (NIPPV)*.

Indications for ICU admission and mechanical ventilation of COPD patients :

- a) Severe dyspnea that responds inadequately to initial therapy.
- b) Confusion , coma.
- c) Persistent hypoxemia ($\text{PaO}_2 < 50 \text{ mmHg}$)
- d) Persistent hypercapnia ($\text{PaCO}_2 > 60 \text{ mmHg}$).
- e) Severe acidosis.



BRONCHIAL ASTHMA

Definition :

It is a chronic inflammatory airway disease characterized by :

- Airflow limitation which is usually reversible spontaneously or with treatment.
- Airway hyper-responsiveness to wide range of stimuli.
- Periodicity & diurnal variability of symptoms.

Airway obstruction occurs due to a combination of:

- Smooth muscle contraction.
- Airway lumen secretions.
- Edema of bronchial mucosa & accumulation of inflammatory cells.

May become irreversible over time due to:

- Basement membrane thickening, collagen deposition, and epithelial damage.
- Airway remodeling occurs in chronic disease, with smooth muscle hypertrophy.

Classifications :

I. Extrinsic asthma :

- In which an environmental inducing agent can be identified.
- Occurs most frequently in atopic individuals. Onset usually in childhood.
- Frequently associated with other atopic diseases e.g. atopic dermatitis, allergic rhinitis.

II. Intrinsic asthma :

- No causative agent can be identified.
- Starts usually in middle age (late onset).
- Not associated with other atopic diseases.

Differentiating parameters	Extrinsic	Intrinsic
- Age of onset	Childhood	Middle age
- Precipitating factor	Obvious	Not obvious
- Family history	Allergy	Bronchial asthma
- Atopic tendency	Usually apparent	Absent
- IgE level	Raised	Not raised
- Skin test	Positive	Negative
- Asthma	Intermittent	Less labile & often severe

Allergens causing asthma :

- ☠ House dust mites.
- ☠ Animal hair and bird feathers.
- ☠ Pollens.
- ☠ Fungal allergens : aspergillus.
- ☠ Rarely foods.

Triggers of asthma attacks :

- Allergens.
- Air pollution : smoking, chemical oxidants released from motor vehicle exhaust.
- Respiratory infections : especially viral.
- Iatrogenic : aspirin, β blockers.
- Occupational : occupational asthma occurs when agents at work place cause asthma e.g. isocyanates, woods, formaldehyde, latex ...etc)
- Cold air and exercise : due to histamine & leukotriene released from mast cells caused by post-thermal changes.

Pathogenesis of bronchial asthma :**1. Immunological mechanism :**

Stimulus (allergen) ⇒ Bronchial narrowing

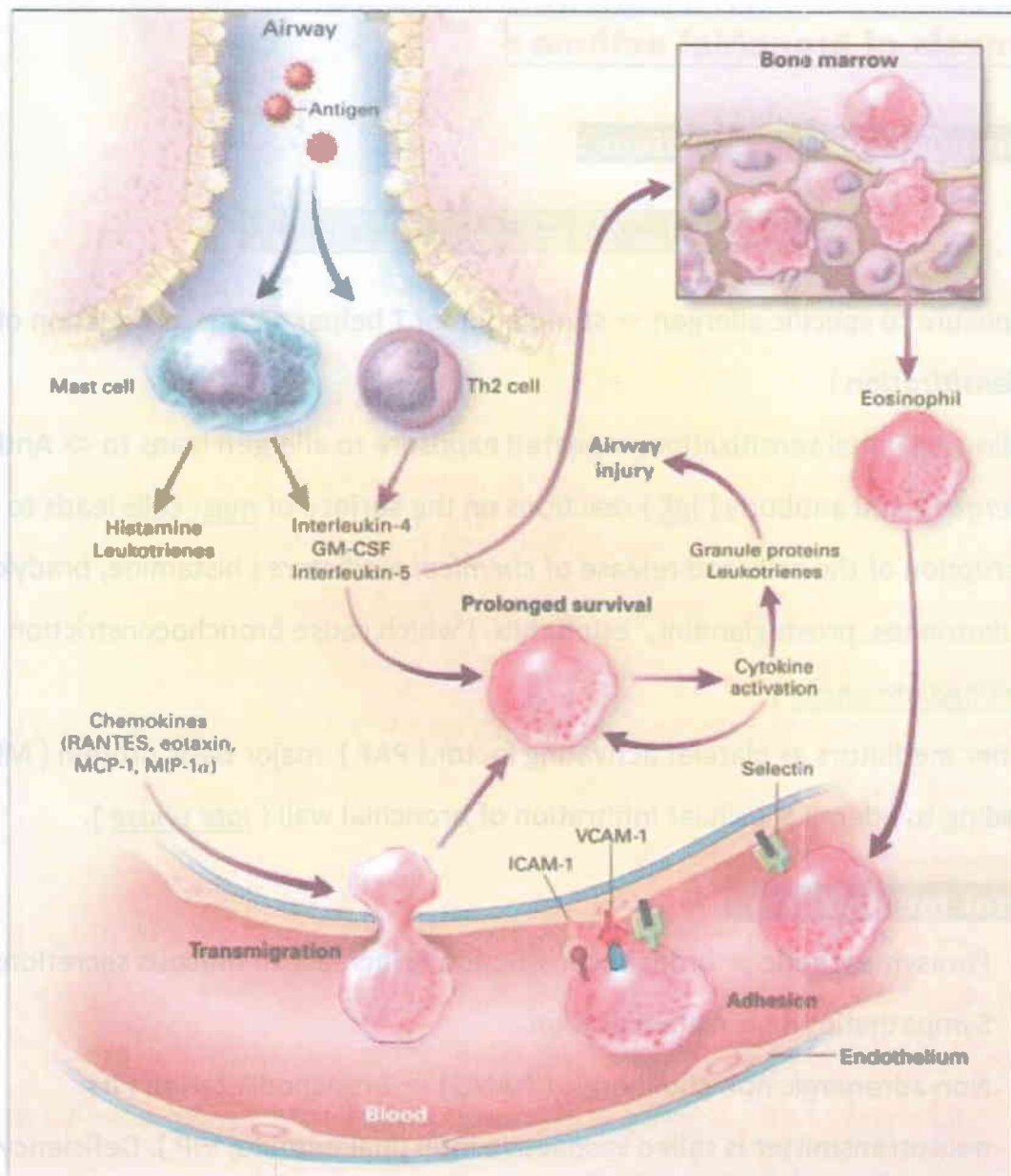
- a) Exposure to specific allergen → stimulation of T helper cells → production of IgE (**Sensitization**)
- b) Following initial sensitization, repeated exposure to allergen leads to ⇒ Antigen (*allergen*) and antibody (*IgE*) reactions on the surface of *mast cells* leads to disruption of the cells and release of *chemical mediators* (histamine, bradykinin, leukotrienes, prostaglandins, eosinophils) which cause bronchoconstriction (*immediate phase*).
- c) Other mediators as platelet activating factor (PAF), major basic protein (MBP) leading to edema & cellular infiltration of bronchial wall (*late phase*).

2. Neural mechanism :

- Parasympathetic → bronchoconstriction & increase in mucous secretions.
- Sympathetic → bronchodilatation.
- Non adrenergic non cholinergic (NANC) → bronchodilatation (its neurotransmitter is called vasoactive intestinal peptide, VIP). Deficiency of this system ⇒ bronchospasm.

3. Genetic factor :

- Genetic factor plays a major role in regulation of IgE production.
- Asthma is a polygenetic disease e.g.
 - Chromosome 5 contains genes controlling production of cytokines.
 - Chromosome 2 contains genes controlling IgE synthesis.
 - Chromosome 20 contains gene called (ADAM33) which is strongly associated with airway hyper-responsiveness & airway remodeling.



Inhaled antigen activates mast cells and Th2 cells in the airway. They in turn induce the production of mediators of inflammation (such as histamine and leukotrienes) and cytokines including interleukin-4 and interleukin-5. Interleukin-5 travels to the bone marrow and causes terminal differentiation of eosinophils. Circulating eosinophils enter the area of allergic inflammation and begin migrating to the lung by rolling, through interactions with selectins, and eventually adhering to endothelium through the binding of integrins to members of the immunoglobulin superfamily of adhesion proteins: vascular-cell adhesion molecule 1 (VCAM-1) and intercellular adhesion molecule 1 (ICAM-1). As the eosinophils enter the matrix of the airway through the influence of various chemokines and cytokines, their survival is prolonged by interleukin-4 and granulocyte-macrophage colony-stimulating factor (GM-CSF). On activation, the eosinophil releases inflammatory mediators, such as leukotrienes and granule proteins, to injure airway tissues. In addition, eosinophils can generate GM-CSF to prolong and potentiate their survival and contribution to persistent airway inflammation. MCP-1, monocyte chemotactic protein; and MIP-1 α , macrophage inflammatory protein.

Clinical picture :**Symptoms :**

1. **Recurrent attacks of :** 
 - Wheeze.
 - Shortness of breath & chest tightness.
 - Cough.
2. Symptoms occur or worsen at night (and early morning).
3. Symptoms occur or worsen after allergen exposure, exercise, cold air, and upper respiratory tract infections.
4. Family history of asthma or atopic diseases.

Signs :

- i. **In between the attacks :** No signs are detected.
- ii. **During the attacks :**
 - Hyperinflation of the chest , with an increased anteroposterior thoracic diameter and a low diaphragm.
 - **Wheezing**, most marked in expiration, is the most characteristic breath sound of asthma but it is an unreliable indicator of severity.
 - Vesicular breath sound with prolonged expiration due to bronchospasm.
 - Tachycardia, tachypnea & working accessory respiratory muscles.

Complications of asthma :

1. Acute severe asthma (*Status asthmaticus*)
2. Pneumothorax.
3. Psychological troubles.
4. Respiratory failure & Cor pulmonale.
5. Complications of cough : e.g. fracture of ribs.
6. Side effects of medications : arrhythmias.

Investigations :**1- Pulmonary function tests :** (corner stone of diagnosis)

- May be normal between the attacks.
- **Reduced FEV₁ & FEV₁/FVC %** during the attacks.
- Test of reversibility (*Bronchodilator test*) : usually FEV₁ improve > **15 %** after inhalation of short acting β_2 agonist. (unlike COPD, FEV₁ response is < **15 %**)



Response to bronchodilators may not be present in severe chronic asthma when little reversibility can be demonstrated.

- **Significant (> 20%) diurnal peak expiratory flow rate (PEFr) variability** on at least 3 days per week for a minimum of **2** weeks.
- **Bronchial provocation test** : Using histamine, methacholine or exercise to induce airway hyper-responsiveness.

2- Chest X-ray :

- **Not diagnostic** for asthma. Normal chest X-ray is the most common finding.
- Done mainly to exclude pneumonia, pneumothorax, or shadows e.g. allergic bronchopulmonary aspergillosis.

3- Detection of allergen :

- **Skin prick tests** : should be performed to help identify allergic cause.
- Specific bronchoprovocation test using inhaled antigens.

4- Blood picture :

- Eosinophilia $> 400/\text{cm}^2$ may be present in allergic cases.
- Leukocytosis due to infection.

5- Blood gases :

In acute severe attacks : $\downarrow$ PaO_2 with normal PaCO_2 . Increase in PaCO_2 is a bad prognosis and considered as an indication of mechanical ventilation.

6- Sputum examination :

- Eosinophils are detected in the sputum.
- Curschmann's spirals : yellow white long threads composed of epithelium, eosinophils & mucous (casts of the distal airways) .
- Charcot- leyden crystals : breakdown products of eosinophils.
- Creola bodies : clusters of columnar bronchial epithelium.

7- ECG : to exclude cardiac causes of dyspnea.

Classifications of degree of asthma according to severity :

Degree	Days with symptoms	Nights with symptoms	PEFR or FEV1	PEFR variability
Mild intermittent	≤ 2 days/week	≤ 2 nights/month	$> 80\%$	$< 20\%$
Mild persistent	> 2 days/week But < 1 per day	> 2 nights/month	$> 80\%$	20 – 30%
Moderate persistent	Daily	> 1 night /week	60 – 80%	$> 30\%$
Severe persistent	Continual	Frequent	$< 60\%$	$> 30\%$

Source National Asthma Education and Prevention Program.

Differential diagnosis :

1. **From other causes of wheezing :** "All that wheezes is not asthma"
 - COPD : predominantly irreversible.
 - Cardiac asthma.
 - Carcinoid syndrome : usually associated with stridor, not wheezing.
 - Churg-Strauss vasculitis.
 - Upper airway obstruction due to foreign body, tumor, laryngeal edema.
2. **From other causes of paroxysmal dyspnea :**
 - Tetany.
 - Myasthenia crises.
 - Recurrent pulmonary emboli.
 - Hysterical dyspnea.
3. Drug induced cough e.g. ACEIs
4. Vocal cord dysfunction (*Factitious asthma*).

Treatment :

Components of asthma treatment : 6 points

- 1- Patient and family education.
- 2- Assessment and monitoring of asthma severity.
- 3- Environmental control & avoidance of risk factors (triggers)
- 4- Establish individual medication plan for long term management.
- 5- Establish individual plans for managing exacerbations.
- 6- Provide regular follow up care.

Goals of treatment : 4 goals

1. Aim for no symptoms / near normal lung function on minimal treatment.
2. Prevent asthma exacerbations.
3. Avoid adverse effects from asthma medications.
4. Prevent development of irreversible limitation.

I. Pharmacotherapy :

A stepwise approach to the management of asthma :

Degree	During the attack	In-between the attacks
Step 1 : Mild intermittent	Short acting β_2 agonist e.g. Salbutamol inhaler (<i>Ventolin</i>)	No daily medication needed
Step 2 : Mild persistent	As step 1	 Low dose inhaled corticosteroid ($\leq 500 \mu\text{g}$) e.g. beclomethazone dipropionate  Long acting inhaled β_2 agonist e.g. Salmeterol (<i>Metrovent</i>)  Cromones e.g. Disodium cromoglycate (<i>Intal</i>) inhaler  Anti-leukotrienes (<i>Singulair</i>)  Sustained release Theophylline
Step 3 : Moderate persistent	As step 1 <u>Plus</u> Anti-cholinergic drug e.g. Ipratropium bromide inhaler (<i>Atrovent</i>)	 Medium dose inhaled corticosteroid ($500\text{-}1000 \mu\text{g}$) beclomethazone dipropionate.  Long acting inhaled β_2 agonist e.g. Salmeterol (<i>Metrovent</i>) .  Cromones e.g. Disodium cromoglycate.  Anti-leukotrienes (<i>Singulair</i>) .  Theophylline.
Step 4 : Severe persistent	As step 3	 High dose inhaled corticosteroid ($> 1000 \mu\text{g}$) beclomethazone.  Long acting inhaled β_2 agonist e.g. Salmeterol (<i>Metrovent</i>) .  Cromones e.g. Disodium cromoglycate.  Anti-leukotrienes (<i>Singulair</i>) .  Theophylline.

II. Immunotherapy :

(Desensitization)

Allergen immunotherapy indicated when :

- There a clear evidence of relationship between symptoms and exposure to allergen.
- Poor response with pharmacological therapy.

Pharmacology of drugs used in treatment of bronchial asthma

Medications used for asthma are classified as either reliever or controller (*preventer*)

a) **Reliever drugs** : (*short acting bronchodilators*)

Drugs which aim to relieve patient symptoms during the attacks.

1. Short acting β_2 agonists :

- ✎ Salbutamol (*Ventolin*) 100 μ g inhaler : 2 puff as needed.
- ✎ Terbutaline (*Bricanyl*) 250 μ g inhaler : 2 puff as needed.
- Stimulation of β_2 receptors result in bronchial smooth muscle relaxation.
- Aerosol delivery of these drugs provide more rapid onset of action & less side effects than the oral delivery.
- Side effects : Tachycardia, Tremors, Glaucoma, Hypertension.

2. Anti-cholinergic drugs : Ipratropium bromide (*Atrovent*) inhaler

- They are non-selective anti-muscarinic agents.
- May be additive to β_2 agonists especially to relieve asthma exacerbations (*Combivent*)
- The major disadvantages of the anti-cholinergics are that they are slow to act (60 to 90 min may be required before peak bronchodilation is achieved) and they are of only modest potency.

3. Methylxanthines e.g Theophylline :

- Theophyllin has a bronchodilator effect given orally, suppository or slow IV infusion in severe cases.
- some authorities now place these compounds in the “controller” class.

- It is used as a long acting drug to guard against nocturnal asthma and IV route in a case of acute severe asthma.
- Side effects :
 - ✖ Gastritis, nervousness, headache, arrhythmias and convulsions.
 - ✖ Wide range of drug interactions : e.g. erythromycin, cimetidine, and propranolol decrease its clearance. Smoking & phenytoin increase its clearance. **MCQ**

b) Controller (preventer) drugs : drugs used in-between attacks

- Drugs are taken on long term aiming to get control of the disease.
- They include anti-inflammatory agents & long acting bronchodilators.
- Inhaled corticosteroids are at present the most effective controllers. **MCQ**

1. Inhaled corticosteroids :

- The anti-inflammatory effect of corticosteroids decreases airway inflammation, hyperreactivity & exacerbations.
 - ✖ Beclomethasone dipropionate.
 - ✖ Budesonide (*Pulmicort*)
 - ✖ Fluticasone propionate (*Flixotide*)
- **Side effects :**
 - Dysphonia.
 - Oropharyngeal candidiasis : avoided by mouth washing after use.

2. Systemic steroids :

- Oral steroids : Prednisone, Prednisilone.
- Injected steroids : Hydrocortisone, Dexamethasone.
- The dose should be kept as low as possible to minimize side-effects.
- Systemic side effects of corticosteroids : see *Endocrinology book*.

3. Cromones :

- ✖ Disodium cromoglycate (*Intal*).
- ✖ Nedocromil sodium.
- Administered only by inhalation.

- **Mechanism of action** : Their major therapeutic effect is to inhibit the degranulation of mast cells, preventing the release of the chemical mediators. *So, these drugs used to be called mast cell stabilizers, but this term is now **obsolete** since the drugs may also have suppressive effect on eosinophils & macrophages.*
- **Role of therapy** : They are most effective in atopic patients and in exercise induced asthma.

4. Anti-leukotrienes : Montelukast (Singulair tab)

5. Long acting β_2 agonists :

- ✗ Salmeterol (Metrovent).
- ✗ Formoterol (Oxis)
- Mode of administration : Inhaled.
- Used in combination with inhaled corticosteroids.

6. Anti- IgE :

- Omalizumab : is a humanized anti-IgE antibody.
- Mode of administration : S.C. every 2-4 weeks.

Acute severe asthma

Definition :

The term "status asthmaticus" was defined as asthma that had failed to resolve with therapy in 24 hours. This term has now been discarded & replaced by "acute severe asthma" i.e. severe asthma that has not been controlled by the patient's use of medication.

Clinical picture :

Symptoms : A, B, C, D

1. **Anxiety.**
2. **Breathlessness at rest.**
3. **Sweating.** ☺
4. **Difficult speech** : patient unable to complete sentences in one breath.

Signs :

- Respiratory rate : **> 25/min.**
- Tachycardia : **> 110/min**
- Pulsus paradoxus in some patients (inspiratory fall of systolic blood pressure > 10 mmHg)
- Chest auscultation : Inspiratory & expiratory wheeze.
- **PEFR : 33-50% of predicted.**

Criteria for diagnosis :

Acute severe asthma	Any one of :
	Peak expiratory flow rate : 33-50%
	Respiratory rate ≥ 25 breaths/min
	Heart rate ≥ 110 beats/min
	Unable to complete sentences in one breath

Life threatening asthma	Any one of the following in a person with severe asthma :	
	Clinical signs	Measurements
	Silent chest	PEFR < 33%
	Exhaustion	Oxygen saturation < 92%
	Arrhythmia	PaO ₂ < 60mmHg despite treatment with O ₂
	Low blood pressure	"Normal" PaCO ₂
	Cyanosis	
	Altered level of consciousness	
Poor respiratory effort		
Near-fatal asthma	High PaCO ₂	

☠ Fatality in asthma is due to cardiac arrest secondary to hypoxia and acidosis

Treatment of acute severe asthma :

1. Oxygen therapy 60% is given to maintain the oxygen saturation above 92% .
2. **Short acting β_2 agonists :** The first line therapy MCQ
 - Salbutamol is given either parenterally or by inhalation.
 - The inhaled forms are superior to the parenteral route and have fewer side effects.
 - Parenteral route is reserved for patients who are so dyspneic that they can't take deep enough breaths.
3. **Hydrocortisone :**
 - 100 mg/6h for the first 24 hours IV then prednisone 60mg orally should be given daily for 2 weeks then gradual tapering.
 - It should be given as soon as possible because peak onset of action can take 4-6 hours.
4. **Aminophylline :** ?
 - Infusion very slowly (over 20 min.). Careful monitoring is required.
 - IV aminophylline in the treatment of acute severe asthma in one word is a *bad medicine*, as several studies have failed to show any benefit plus undesired side effects e.g. *arrhythmia* ☠
5. **Hydration :** plenty of oral & IV fluids. Potassium supplements may be necessary because repeated doses of salbutamol can lower serum potassium.
6. **Mechanical ventilation :**

Indications :

 - Deteriorating PEFr.
 - Persistent hypoxemia or hypercapnia.
 - Exhaustion, confusion or drowsiness.
 - Coma or respiratory arrest.
 - Previous history of mechanical ventilation.

PULMONARY TUBERCULOSIS

Causative organism :

1) Typical mycobacteria :

- Mycobacterium tuberculosis : it causes most of cases of tuberculosis.
- Mycobacterium bovis : endemic in cattle & spread to man through infected milk causing gastrointestinal tuberculosis.

2) Atypical mycobacteria (non tuberculous mycobacteria) :

e.g. *M. marinum* , *M. kansasii* , *M. Avium*

It is common in immunocompromised patients occasionally produce pulmonary or lymph node disease.

High risk :

- Age : Infection may occur at any age & is most significant at the extremes of age.
- Race : more in Negros.
- Environmental : Contacts with TB cases , and those living in overcrowded and substandard housing.
- Immunocompromised patients e.g. DM , malnutrition , HIV.
- Habits : smoking , alcoholism.

Source of infection :

1) Human source :

- Air-borne droplet infection e.g. productive cough (a bout of coughing produces 3500 droplet nuclei that equate with speaking for 5 minutes in a normal tone)
- Mother to fetus : through the placenta.

2) Animal source : e.g. milk.

Pathology of TB :

- TB affects any organ in the body, but most frequently involves the lungs.
- Pulmonary TB may be either :

i. Primary TB (*Childhood TB*) : first exposure

- After entry into the lungs , the organism is ingested by alveolar macrophages.
- As a result of natural defenses of the tubercle bacilli, alveolar macrophages may be unsuccessful in destroying the bacilli, which then lie dormant within the macrophage and may travel via the pulmonary lymphatics & a few escape into the bloodstream.
- The first infection with *M. tuberculosis* is known as primary tuberculosis. It is usually **subpleural**, often in the mid to upper zones (*Ghon's focus*, single granulomatous lesion).

TB granuloma consists of a central area of necrotic material of a cheesy nature, called caseation , surrounded by epithelioid cells and Langhans' giant cells with multiple nuclei. Lymphocytes are present and there is a varying degree of fibrosis.

➤ **Components of primary complex :**

- i. Ghon's focus (*TB granuloma*).
- ii. Lymphangitis.
- iii. Lymphadenitis in the draining LN.

➤ **Fate of the primary complex :**

- 1) **Healing** : It heals completely and many become calcified. It is known that at least 20% of these calcified primary lesions contain tubercle bacilli, capable of being activated by depression of the host defense system.
- 2) **Progressive primary TB** : in the setting of acute infection in immunocompromised patients (see below)

II. **Secondary TB** (*post primary TB*) : due to one of the following

- a) Reactivation of healed primary focus.
- b) Hematogenous spread.
- c) Reinfection.
- Secondary TB is generally found in the **upper lung zones** due to high ventilation/perfusion ratio as TB bacilli are aerobic organisms.
- Fate of post primary TB :
 - 1) Fibrotic type : small lesion that pass rapidly to fibrosis. It occurs with a small dose of bacilli and high immunity.
 - 2) Cavitory fibrocaceous TB.
 - 3) TB bronchopneumonia.
 - 4) Miliary TB : see below

Clinical picture : TB presents with any / or no symptoms , with any / no signs.

Symptoms :

Clinical picture of primary TB :

1. Asymptomatic in most cases.
2. Cough : may occur & mimic whooping cough. Productive cough & hemoptysis may occur.
3. Hypersensitivity : Erythema nodosum , conjunctivitis , pleural effusion.
4. Persistent collapse followed by bronchiectasis of the middle lobe (Brok's syndrome).
5. Manifestations of progressive primary TB :
 - a) Enlargement of Gohn's focus e.g.TB pneumonia , cavitation.
 - b) Enlargement of LN e.g. mediastinal syndrome , collapse.
 - c) LN rupture into :
 - Pleura : pleurisy.
 - Blood vessels : miliary TB.

Clinical picture of post primary TB :

- 1) Asymptomatic , discovered accidentally.
- 2) General symptoms : Loss of weight , loss of appetite , night fever , night sweat.
- 3) Chronic cough is the most common pulmonary symptom. It may be dry at first but typically becomes productive as the disease progresses.
- 4) Hemoptysis is common especially with cavitary disease. Most hemoptysis is small volume.
- 5) Dyspnea & wheezes may occur.
- 6) Chest pain.

Signs : often non-specific

GENERAL SIGNS :

- Fever : typically occurring at the evening.
- Tachypnea.
- Tachycardia.
- Cachexia in advanced cases.
- Clubbing : may occur in cases complicated with suppurative lung syndrome.

LOCAL SIGNS : nothing or anything

- Examination may be normal.
- Lymphadenopathy (*particularly cervical*)
- Crepitations.
- Signs of cavitation.
- Signs of consolidation.
- Signs of a pleural effusion.
- Signs of fibrosis or collapse may be found.
- Look for evidence of extrapulmonary disease, e.g. skin, joints, CNS, retina ...

What are the organs resistant to develop TB?

- Cardiac muscle
- Skeletal muscles
- Thyroid gland
- Pancreas.

not specific , usually
localized to the apical
part of the lung

Complications :

- Pleural TB : see pleural effusion
- Bronchiectasis : middle lobe syndrome , bronchiectasis sicca hemorrhagica.
- Pulmonary fibrosis.
- Mycetoma (*Aspergilloma*) : fungus infection within a tuberculous cavity.
- Massive hemoptysis : is rare, and is most common with consequent bronchiectasis formation or due to rupture of malformed vessels in the wall of mycetoma cavity.
- TB laryngitis.
- Amyloidosis.
- Respiratory failure.
- Cor pulmonale.
- **Miliary TB :**
 - ✓ Rupture of caseous focus into a blood vessels may result in formation of multiple tuberculosis foci (1 – 5 mm) in the lung & other organs of the body.
 - ✓ It presents as fever , loss of weight , TB meningitis , hepatosplenomegaly , Choroid tubercle in the eye.

Investigations :

TB is a clinical possibility , radiological probability and a bacteriological certainty 🎵 🎵

1- Radiology :

Chest X-ray : (The usual location is in the apical lung)

- May show patchy shadowing in one or both apices.
- Persistence of abnormal shadows for several weeks with treatment (*of course not anti-TB drugs*)
- Radiological signs of complications : e.g.
 - Cavity , Consolidation , Collapse , Calcification , Fibrosis.
 - Miliary shadows. (*diffuse small nodular densities*)
 - LN enlargement. (hilar or paratracheal LN).
 - Pleural effusion.

VALUE OF RADIOLOGY IN TUBERCULOSIS :

- i. Early detection of TB.
- ii. The extent of TB :
 - a) Minimal lesion : no cavitation.
 - b) Moderately advanced lesion : Total diameter of cavitations < 4 cm
 - c) Advanced lesion : more extensive than moderately advanced.

**2- Bacteriological examination : gold standard for diagnosis**

- Ziehl-Neelsen (ZN) stain and culture on Lowenstein Jensen media is required for definitive diagnosis.
- Three consecutive morning sputum specimens are advised.
- PCR (*Polymerase chain reaction*) : provides diagnosis within **48h**.
- Isolation of organism from :
 - Sputum (It can be induced by nebulised hypertonic saline in cases with scanty sputum production)
 - Bronchial lavage.
 - Gastric aspirate in children.
 - CSF , urine.

3- Tuberculin test :

- 0.1 mL of purified protein derivative (PPD) containing 5 tuberculin units is injected intradermally.
- After 72 hours :
 - +ve tuberculin test (≥ 10 mm induration) : suggestive of TB infection in patients not received BCG vaccine (bacillus Calmette-Guérin).
 - -ve tuberculin test : usually excludes TB .

FALSE -VE TEST :

- Cortisone therapy or Immunocompromised patients.
- Improper technique.
- Pre immune phase (it takes 2–10 weeks after tuberculosis infection for an immune response to PPD to develop)
- fulminant tuberculosis especially military TB.

**4- Invasive method :**

- Pleural aspiration.
- Bronchoscopy with BAL (bronchoalveolar lavage)

5- Blood examination :

- Increased ESR.
- Normochromic normocytic anemia may be present specially in military TB.
- Renal & liver function tests.

Differential diagnosis : *TB enters in the differential diagnosis of almost all chest diseases*

- 1) Bronchogenic carcinoma.
- 2) Pneumonia
- 3) Other causes of hemoptysis.
- 4) Fever of unknown origin.

Treatment :**Prevention of TB :****i. Increasing the host defense :**

- General : good nutrition , good housing , good sleep.
- BCG (*bacillus Calmette-Guérin*) : for whole community.
- INH : for contact.

ii. Prevention of infection :

- From sputum : Case finding , Isolation & Proper treatment.
- From milk : Pasteurization of milk.

II. Therapeutic treatment :

> General :

- ✓ Reassurance & rehabilitation.
- ✓ Follow up after healing for a period of 5 years.
- ✓ Bed rest until the activity of the disease is controlled, Prolonged bed rest is not essential.

> Specific treatment : (Anti-tuberculous drugs)

These items should be discussed 

- 1) Main principles.
- 2) Drugs.
- 3) Regimens.
- 4) Treatment of TB in special situations
- 5) TB & cortisone.

1) Main principles : 2C , 3P

- **C**ontinuous.
- **C**ombined.
- **P**rolonged periods (6 - 9 months or more)
- **P**roper dose.
- **P**yridoxine (vitamin B₆) should be administrated with INH is mandatory to prevent peripheral neuropathy.

2) Drugs :

The drugs are classified as standard (1st line) & reserve (2nd line).

a) The standard drugs : **RESPIRATION**

- **R**ifampicin. (R)
- **E**thambutol. (E)
- **S**treptomycin. (S)
- **P**yrazinamide. (Z)
- **INH** (Isonicotinic acid hydrazide , isoniazid). (H)

DRUG	DOSE (mg/kg/day) ☺ 5 10 15 20 25	SIDE EFFECT
INH	5 - 10 orally	○ Idiosyncrasy. ○ Neuropathy. ○ Hepatotoxicity.
RIFAMPICIN	10 - 15 orally	○ Hepatotoxicity. ○ GIT irritation.
STREPTOMYCIN	15 - 20 IM	○ Ototoxicity. ? ○ Nephrotoxicity.
ETHAMBUTOL	20 - 25 orally	○ Optic neuritis 👁
PYRAZINAMIDE.	25 - 30 orally	○ Hepatotoxicity. ○ Gout.

b) Reserve drugs : (second line drugs)

- ✂ Capreomycin : 1 - 2 g/d , SE : nephro- & ototoxicity.
- ✂ Kanamycin : 1 - 2 g/d, SE : nephro- & ototoxicity.
- ✂ Viomycin : 1 - 2 g/d
- ✂ Paraaminosalicylic acid (PAS).
- ✂ Cycloserin : 15 mg/kg/d. SE : headache , psychosis.
- ✂ Ciprofloxacin , Ofloxacin.

3) Regimens : 6 - 9 month continuous regimen

- Initial phase : 2 months of 3 - 4 drugs (Rifampicin + INH + one or two drugs from the standard drugs e.g. Z , S or E)
- Continuation phase : 4 - 7 months of Rifampicin + INH.

4) Treatment of TB in special situations :

➤ Renal failure :

- Rifampicin is the safest drug.
- H , R , Z can be used , S & E are contraindicated.

➤ **Liver cell failure :**

- SHE can be used.
- R , Z are contraindicated.

➤ **Pregnancy :** HE (INH , Ethambutol) can be used ☺

5) TB & cortisone : Cortisone may be used carefully in some cases :

- TB meningitis.
- Genitourinary tuberculosis to prevent ureteric strictures.
- Pericarditis , peritonitis & pleural effusion to prevent fibrosis.
- Lymph node enlargement.

➤ **Surgery in tuberculosis :**

- The role of surgery is limited nowadays due to effective chemotherapeutic agents.
- Pleuro-pulmonary resections in resistant cases.

Prognosis of TB :

Almost all properly treated patients with tuberculosis can be cured. Relapse rates are less than **5%** with current regimens.

Extra-Pulmonary Tuberculosis

1. Pleural tuberculosis : see before
2. Tuberculous pericarditis.
3. TB peritonitis & ascites : *see GIT book p 112*
4. Gastrointestinal tuberculosis :
 - The ileo-cecal area & jejunum-ileum are the commonest sites.
 - C/P : Abdominal pain , diarrhea and Palpable abdominal mass.
5. Bone & joint tuberculosis.
6. Genitourinary tract tuberculosis.
7. CNS tuberculosis.
8. Cutaneous tuberculosis.
9. Ocular tuberculosis : Phlyctenular conjunctivitis , Choroidal tubercles.
10. Adrenal gland : Addison disease.

LUNG CANCER

Risk factors :

1. **Cigarette smoking** : *The most important single factor*
 - Smokers have 15 times increase in lung cancer risk compared with non-smokers.
 - Passive smokers also have 2 times increase in risk.
 - Stopping smoking decreases the risk, but the risk remains higher than in people who have never smoked.
2. **Air pollution** : e.g. from motor vehicles, factory emission, coal burning.
3. **Occupational factors** : asbestos exposure, arsenic and heavy metal exposure.
4. **Lung lesions** : MCQ
 - Old fibrosis as in TB may result in scar carcinoma.
 - COPD is important risk factor.
5. **Genetic factor** : may play a role
6. **Diet** : low vitamins A & C increase the risk of lung cancer.

Pathology : WHO classification

Classification	Site	Incidence
Squamous cell carcinoma	Central	35%
Small cell carcinoma (oat cell carcinoma)	Central	20%
Adenocarcinoma	Peripheral	30%
Large cell carcinoma	Peripheral	10%
Others : Pulmonary lymphoma, Carcinoid, sarcoma	Central or peripheral	5%

Spread :**1) Local spread :**

- To the pleura : in the peripheral types leading to pleural manifestations.
- To the mediastinum : in central types leading to mediastinal syndrome.

2) Hematogenous spread : Liver, bones, brain especially in small cell carcinoma.**3) Lymphatic spread :** to hilar, mediastinal, axillary, cervical lymph nodes.**Clinical picture :**

- The patient is usually an elderly male, who is a chronic heavy smoker.
- He may present with any of the following manifestations :

I. Intra-thoracic manifestations :**A) Broncho-pulmonary presentations :****1. Asymptomatic :**

- One fourth of patients who have cancer present with no symptoms at the time of diagnosis.
- Detected accidentally on routine X-ray as a coin shadow in the lung.

2. Primary tumor symptoms : cough, expectoration, dyspnea, chest pain.**3. Hemoptysis :** in the form of blood tinged sputum or rarely red current jelly sputum.**4. Bronchial obstruction :**

- Partial : Emphysema, Bronchiectasis.
- Complete : collapse.

5. Pneumonia : usually recurrent at the same site.**6. Lung abscess :** due to : secondary infection, necrosis of the tumor itself.**7. Thoracic inlet syndrome (superior sulcus syndrome) :** due to pancoast tumor

Pancoast tumor is a tumor occupying the apex of one lung and invading the following :

2 bones, 2 nerves, 2 blood vessels 🎵

✂ **2 bones :** upper 2 ribs.

✂ **2 nerves :** (*sympathetic chain & lower trunk of brachial plexus*)

- **Sympathetic chain invasion :** Horner's syndrome (*ptosis, myosis, enophthalmos, anhydrosis*).
- **Lower trunk of brachial plexus :** pain along the medial aspect of the arm & wasting of the small muscles of the hand.

✂ **2 blood vessels :** (*Superior vena cava, Subclavian artery*)

- **Superior vena cava obstruction :** congested non pulsating neck vein.
- **Subclavian artery :** unequal pulse in both upper limbs.

B) Pleural manifestations :

- Dry pleurisy may occur.
- Malignant effusion : massive, hemorrhagic, rapidly accumulating.
- Transudate : due to compression of azygous vein.
- Chylous effusion : due to obstruction of thoracic duct.
- Empyema : due to rupture of malignant abscess into the pleura.

C) Mediastinal manifestations : cough, dysphagia, hoarseness of voice ...

II. Extra-thoracic :

A) Metastatic manifestations :

- ✂ Liver : jaundice, palpable tender liver mass.
- ✂ Bone : bone pain, pathological fracture.
- ✂ Brain : polyneuropathy, myopathy, paralysis or paresis.
- ✂ Heart : arrhythmia, pericardial effusion.

B) Non-metastatic manifestations : (*Para-malignant syndrome*)

These manifestations are mostly common with small cell carcinoma.

Endocrinal : as a result of production of abnormal metabolites.

- Cushing : due to ectopic ACTH secretion.
- Hypercalcemia : due to PTH related peptide secretion.

- Inappropriate secretion of ADH → hyponatremia.
- Gynecomastia.

Neurological :

- Polyneuropathy.
- Myopathy.
- Myasthenia (*Eaton Lambert syndrome*)

Hematological :

- Thromboembolic manifestations.
- Anemia.
- Leukemoid reaction.

Skin :

- Acanthosis nigricans.
- Dermatomyositis.

Others :

- Cachexia.
- Clubbing and hypertrophic pulmonary osteo-arthritis (HPOA) : more common in squamous and adenocarcinoma.

Investigations :

1- Radiology :

a) Chest X-ray : may show :

- Coin shadow in the lung.
- Area of collapse, consolidation, lung abscess, mediastinal mass.
- Pleural effusion.
- Rib erosion.
- Hilar LN enlargement.
- Elevated diaphragm.

b) CT chest : for accurate localization & evaluation LN for staging.

2- Sputum examination : for malignant cells.

3- Invasive method :

- Bronchoscopy with BAL : +ve especially in central types.
- Transthoracic needle aspiration : for biopsy from peripheral lung lesions.
- Pleural aspiration.

4- Blood examination :

- Increased ESR.
- Serum electrolytes : Na, Ca.
- Renal & liver function tests.

5- Investigations for metastasis :

- Abdominal Ultrasound.
- Bone scan.
- Brain CT

Differential diagnosis :

- TB, Pneumonia, lung abscess.
- Pulmonary infarction.
- Benign tumors
- Other causes of pleural effusion.
- Other causes of mediastinal syndrome.

Staging :

It gives prognostic information and guide treatment decision.

I. Small cell lung cancer :

- A. Limited :** confined to ipsilateral hemi-thorax and supraclavicular lymph nodes
- B. Extensive :** everything else

II. Non-small cell lung cancer : is commonly classified using TNM staging system



Extent of primary tumor (T)

Tx	Primary tumor cannot be assessed, or tumor proven by presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy.
T0	No evidence of primary tumor
Tis	Carcinoma <i>in situ</i>
T1	Tumor < 3 cm surrounded by lung or visceral pleura, without bronchoscopic evidence of invasion more proximal than the lobar bronchus
T2	Tumor > 3 cm, invading visceral pleura or main bronchus > 2 cm distal to carina.
T3	Tumor of any size which invades chest wall, diaphragm, parietal pericardium, mediastinal pleura, or tumor in main bronchus < 2 cm distal to carina.
T4	Tumor of any size invading: heart, great vessels, trachea, esophagus, carina, vertebral body, or malignant pleural or pericardial effusion.

Regional lymph nodes (N)

Nx	Cannot be assessed
N0	No regional lymph node metastasis
N1	Ipsilateral peri-bronchial and/or ipsilateral hilar nodes
N2	Ipsilateral mediastinal and/or subcarinal nodes
N3	Contralateral mediastinal, hilar nodes, or any scalene or supraclavicular nodes

Distant metastasis (M)

Mx	Cannot be assessed
M0	No distant metastasis
M1	Distant metastasis

Stage grouping :

Stage	TNM subset
0	Tis
IA	T1 N0 M0
IB	T2 N0 M0
IIA	T1 N1 M0
IIB	T2 N1 M0
	T3 N0 M0

IIIA	T1 N2 M0
	T2 N2 M0
	T3 N1-2 M0
IIIB	T4 with any N M0
	Any T N3 M0
IV	Any T, Any N, M1

Treatment :

I. **Surgical resection** : therapy of choice for patients with non-small cell carcinoma.

Criteria for operability :

- When the tumor is confined to the lung & away from carina by > 2cm.
- Good lung functions.
- No metastases.

Contraindications to surgery :

- Distant metastases.
- Invasion of the mediastinum.
- Malignant pleural effusion.
- Severe cardiac or other medical problems.

II. **Radiotherapy** : less effective than surgery.

III. **Chemotherapy** (*cisplatin based chemotherapy*) : especially for small cell carcinoma using combination of cytotoxic drugs sometimes in combination with radiotherapy.

IV. **Symptomatic treatment** : e.g. relieve of pain.

Treatment of non-small cell lung cancer :

Stage I	Complete surgical resection
Stage II	Surgical resection followed by radiotherapy
Stage IIIA	Surgical resection followed by radiotherapy & chemotherapy
Stage IIIB	Chemotherapy with radiotherapy This stage is inoperable.
Stage IV	Cisplatin based chemotherapy



Treatment of small cell lung cancer : chemo-sensitive

- The major problem in treating small cell carcinoma is the presence of distant metastases at presentation.
- No role of surgery except in solitary pulmonary nodule with no evidence of metastases. This is rare.
- Combination chemotherapy (cisplatin, cyclophosphamid,...) : is used for limited and extensive small cell carcinoma.

Bronchial adenoma (*carcinoid tumor*)

- It is a locally malignant tumor, it originates from endocrine cells.
- Pathology : 2 pathological types (Pedunculated, Sessile)
- **Clinical picture :**
 1. Hemoptysis : It is the most important & frequent symptom due to marked vascularity of the tumor.
 2. Bronchial obstruction :
 - Partial : Emphysema, Bronchiectasis.
 - Complete : collapse.
 - Intermittent : fleeting atelectasis.
 3. Carcinoid syndrome :

Attacks of flushing, diarrhea, bronchospasm, hypotension, abdominal cramps & may be associated with cardiac valvular lesions, due to secretion of serotonin & other substances by the tumor.
 4. Carcinoid tumors can also be associated with Cushing's syndrome, due to ectopic tumor ACTH production.

- Investigations :**1. X ray :**

- May be normal.
- Coin shadow.
- Localized emphysema or lung abscess.
- Fleeting atelectasis.

2. Bronchoscopy : It bleeds easily, so care should be taken.**3. Hydroxy indol acetic acid (HIAA) in urine : (metabolite of serotonin)**

This will be raised in Carcinoid tumors.

- Differential diagnosis of bronchial adenoma :**1- Other causes of hemoptysis with normal X-ray :**

- TB.
- Bronchiectasis.
- Chronic or acute bronchitis.

2- Causes of fleeting shadow :

- Bronchial adenoma.
- Lung hematoma.
- Lung eosinophilia.
- Fissural effusion.

- Treatment :

1. Surgical excision : of the lobe or the segment that contain the tumor.
2. Laser therapy may be used.
3. Argon plasma coagulation (APC)

- Prognosis : good.

PLEURAL TUMOR

 (Mesothelioma)

1- Benign pleural mesothelioma (pleural fibroma)

- C/P : space occupying lesion, hypoglycemia.
- Chest X-ray : D shape opacity.
- Treatment : surgical excision.

2- Malignant mesothelioma :

- Highly malignant with bad prognosis.
- Most common in men between the age of **50 & 70** years.
- The lesion arises from mesothelial cells of pleura.
- **Asbestos exposure** is responsible for at least **85%** of malignant mesothelioma.
- C/P : Chest pain, dyspnea, weight loss & pleural effusion.
- Chest X-ray : Pleural effusion with lobulated pleural thickness.
- Treatment : Radiotherapy or chemotherapy with unsatisfactory results.

We must consider teaching the Egyptian revolution in schools.

Britain's Prime Minister Cameroun

SMOKING

Smoking index : (Packs-year index)

Average number of packs/day X number of years of smoking

NB : Pack = 20 cigarettes (I think that the medical students know this fact now for the first time) ☺

For example : 20 cigarettes/day for about 20 years. Index : $1 \times 20 = 20$

- Mild : up to 20
- Moderate : up to 40
- Severe : > 40

Important terminology :

- **Non-smoker** : is defined as the person who smokes < 1 cigarette / day for one year.
Or up to one pack / month or up to 20 pack in life time.
- **Current smoker** : is a person in regular cigarette smoking up to a month ago.
- **Ex-smoker** : is a person who has quit smoking for at least 6 month.
- **Passive smoker** : second hand smoker ☺

Hazards of smoking :

Chest :

- ☠ COPD.
- ☠ Lung cancer : one cigarette contains more than 4000 carcinogenic compounds.

Cardiovascular :

- ☠ Increases incidence of sudden death, coronary artery disease & malignant hypertension. (*smoking accounts for 30% of all Cardiovascular deaths*).
- ☠ It increases platelets adhesion, aggregation & whole blood viscosity.
- ☠ It increases carboxyhemoglobin & hematocrite value.
- ☠ It increases HR, catecholamine release & sensitivity.

- ☠ Decreases threshold of ventricular fibrillation.
- ☠ Decreases level of HDL.
- ☠ It increases morbidity from peripheral vascular diseases.
- ☠ It increases mortality due to aortic aneurysm.

GIT :

- ☠ Peptic ulcer.
- ☠ Cancer tongue, esophagus & stomach.

Urinary system : cancer bladder.

In female : Osteoporosis, Still birth, Stunted baby growth & congenital anomalies.

Temporal sequences of events following smoking cessation :**1. Heart rate & blood pressure :**

- Normal within **30** minutes of last cigarette.

2. Oxyhemoglobin & CO levels :

- Normal within **8** hours of last cigarette.

3. Nicotine level :

- Normal within **3** days of last cigarette.
- Psychological craving within **3** weeks after last cigarette.

4. Myocardial infarction risk :

- Drops to **50%** of smoker's risk **5** years after last cigarette.

5. Lung cancer :

- Drops to **50%** of smoker's risk **10** years after last cigarette.

RESPIRATORY FAILURE

Definition :

It is a condition in which the respiratory system can't maintain an adequate gas exchange ($\text{PaO}_2 < 60$ mmHg and/or $\text{PaCO}_2 > 50$ mmHg).

Types :

- Type I RF :
 - Hypoxemia without hypercapnia.
 - Mainly due to disturbed diffusion or perfusion.
- Type II RF :
 - Hypoxemia with hypercapnia.
 - Mainly due to disturbed ventilation.

Normal values of arterial blood gases :

- PaO_2 : 80 - 100 mmHg.
- PaCO_2 : 35 - 45 mmHg.
- PH : 7.35 - 7.45
- HCO_3 : 22 - 27 mEq.
- SaO_2 : 95 - 99%

Mechanisms of hypoxemia :

1. Low FiO_2 : (fraction of inspired O_2 , $N = 21\%$) e.g. High attitude , fire places.
2. Hypoventilation.
3. Abnormal diffusion of O_2 from the alveoli into the capillary blood.
4. Ventilation/perfusion (V/Q) mismatch : see below
5. Shunts inside or outside the lung. This can occur due to pathology in the lung as pneumonia or outside the lung as congenital heart disease.

Hypoxia vs Hypoxemia

- Although the terms hypoxia and hypoxemia are often used interchangeably, they are not synonymous.
- Hypoxemia is defined as a condition where PaO_2 is below normal.
- Hypoxia is defined as the failure of oxygenation at the tissue level.
- *Hypoxia may not be present in patients with hypoxemia if the patient compensates for a low PaO_2 by increasing cardiac output or decreasing tissue oxygen consumption. Conversely, patients who are not hypoxemic may be hypoxic if oxygen delivery to tissues is impaired.*
- Hypoxemia is by far the most common cause of hypoxia.

Etiology :**Ventilation disorders : (hypoventilation)****1- CNS causes : (leads to respiratory centre depression)**

- Cerebral stroke , Tumor , Trauma.
- Drugs that depress the respiratory center e.g. morphine, barbiturate.
- Central sleep apnea syndrome.

2- Ventilatory pump limitation :

- Neuromuscular : myopathy , neuropathy , myasthenia gravis.
- Chest wall deformity : kyphoscoliosis.
- Pleural diseases : massive pleural effusion , pneumothorax.

3- Airflow limitation :

- Upper airway obstruction : laryngeal edema , tracheal obstruction.
- Lower airway obstruction :
 - COPD.
 - Bronchial asthma.
 - Bronchial tumors.

Diffusion disorders : alveoli out of function

- Emphysema.
- Pneumonia.
- Pulmonary edema :
 - Cardiogenic : low permeability, high hydrostatic pressure.
 - Non-cardiogenic (ARDS) : high permeability, low hydrostatic pressure.
- Pulmonary fibrosis.

Perfusion disorders :

- Pulmonary embolism.
- Shock.

V/Q mismatch : (ventilation / perfusion mismatch)

- The ventilation and the perfusion of a gas exchanging unit are not matched.
 - "V" - ventilation - the air which reaches the alveoli
 - "Q" - perfusion - the blood which reaches the alveoli
- Normal V/Q ratio = 1 (apex of lung > base of lung)
- Increased V/Q ratio : pulmonary embolism , Emphysema.
- Decreased V/Q ratio :
 - Chronic bronchitis.
 - ↑ lung perfusion : non embolised area of lung in a case of pulmonary embolism.
- An area with no ventilation (and thus a V/Q of zero) is termed "shunt"
- An area with no perfusion (and thus a V/Q undefined) is termed "dead space"

MCQ

Clinical picture :**I. Clinical picture of hypoxia :** 5 C**1- Central cyanosis.****2- Chest manifestations :** (hypoxemia ⇒ ↑ carotid chemoreceptors)

- Tachypnea.
- Dyspnea.

3- CNS manifestations :

- Irritability.
- Loss of concentration.
- Convulsion.
- Coma.

4- CVS manifestations : 2 C

- Core pulmonale.
- Cardiac arrest.

5- Secondary polycythemia.

II. Clinical picture of Hypercapnia : 2 C**1- CNS manifestations :**

- a) CO₂ narcosis : Somnolence , Confusion , Coma.
- b) Cerebral vessels dilatation : ↑ ICT (headache , blurring of vision)
- c) 🧠 : Pupillary dilatation due to sympathetic stimulation.

2- CVS manifestations :

- a) Hyperdynamic circulation (.....)
- b) 🧐 : Congested conjunctiva.

Diagnosis of RF :**1- Diagnosis of hypoxia & hypercapnia :**

- Clinical picture.
- Arterial blood gases.

2- Diagnosis of the causative disease (e.g. COPD)**Treatment of RF :****1- Treatment of the cause : e.g. Antibiotics for infection****2- O₂ inhalation.****3- Mechanical ventilator.****4- Care of airway :**

- Elimination of secretion
- Endotracheal tube.

NB

- Type 1 RF : may be corrected by increasing the inspired oxygen concentration.
- Type 2 RF : may require mechanical ventilation. Also we can use respiratory stimulant such as doxapram.

PULMONARY FIBROSIS

Pulmonary fibrosis is the end-result of many pathological processes from infections to autoimmune diseases. It may be localized or diffuse.

I. Localized pulmonary fibrosis :

a. Infections :

- Granulomatous diseases : TB and fungal infections.
- Fibrosis may follow parenchymatous lesions as non-resolving pneumonia, lung abscess.

b. Non infectious : e.g. after thoracic surgery, trauma.

II. Interstitial lung diseases (ILD) : (*diffuse parenchymal lung disease*)

Interstitial lung disease refers to a group of lung diseases affecting the interstitium (*the alveoli, the alveolar epithelium, the capillary endothelium, and the spaces between these structures, as well as the perivascular and lymphatic tissues*).

Causes of ILD :

1. Inhaled substances : (occupational and environmental factors)

○ Inorganic : (*pneumoconiosis*)

- Silicosis.
- Asbestosis.
- Coal worker's pneumoconiosis.

○ Organic : Hypersensitivity pneumonitis.

2. Drug induced :

- Antibiotics : sulphonamides, penicillin, cephalosporins.
- Chemotherapeutic drugs : methotrexate, cyclophosphamide.
- Antiarrhythmic agents : amiodarone.
- Anti-inflammatory Agents : Aspirin, Gold.
- Drug induced lupus : hydralazine, INH.

3. Connective tissue disease :

- Systemic sclerosis.
- Systemic lupus erythematosus.
- Rheumatoid arthritis.
- Wegener's granulomatosis.
- Churg-Strauss syndrome.

4. Post infections :

- Viral & mycoplasma pneumonia.
- Tuberculosis.
- Fungal infections.

5. Idiopathic :

- Sarcoidosis.
- **Idiopathic pulmonary fibrosis** (Cryptogenic fibrosing alveolitis) : Progressive fibrotic interstitial lung disease of unknown etiology.

6. Acute respiratory distress syndrome (ARDS).**Pathology :**

Pathological features typically include inflammation of alveolar walls, air spaces & terminal bronchioles leading to progressive bilateral destruction of the lung parenchyma.

Clinical picture :

Symptoms : *Key points in the history are :*

1. **Exertional breathlessness** (dyspnea) : may be the only symptom. As the disease progress, dyspnea occurs at rest.
2. Dry cough : is also prominent complaint.
3. Chest pain.
4. Hemoptysis : may occur in cases of intra-alveolar hemorrhage.
5. Symptoms of the cause : e.g. myalgia, arthralgia, ILD might be the result of underlying connective tissue disease.

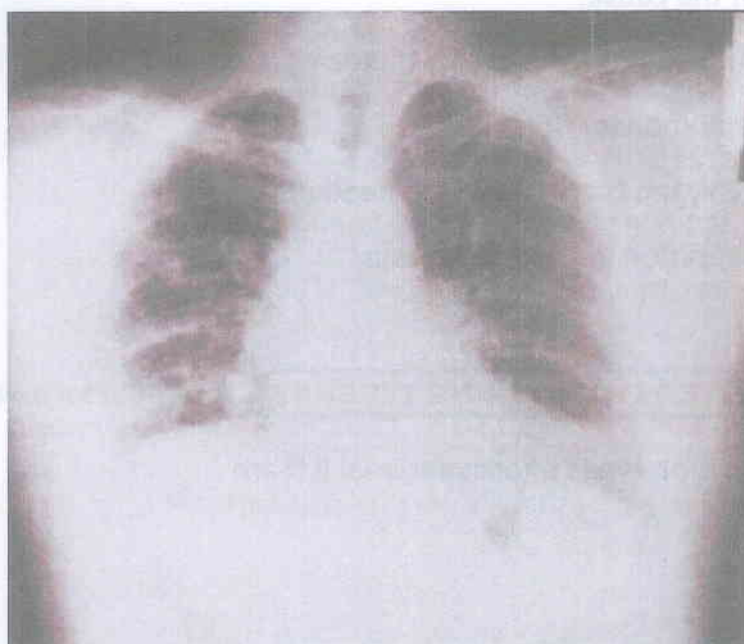
6. History of drug intake or occupational factor.
7. Absence of pulmonary infection or neoplasm.

Signs :**C**

1. **C**yanosis.
2. **C**lubbing.
3. Signs of the **C**ause : e.g. skin rash in SLE.
4. Signs of **C**omplications : respiratory failure, cor-pulmonale.
5. Bilateral basal end inspiratory **C**repitations.

Investigations :**1-Radiology :****a) Chest X-ray :**

- Bilateral pulmonary infiltration with reticulo-nodular shadow.
- In advanced disease, there may be cystic areas and honeycombing.



Chest X-ray shows an idiopathic pulmonary fibrosis

b) High resolution CT : to detect early cases & assess the severity.

- 2- **Laboratory :** to reach the cause
 - ESR & C-reactive protein (CRP).
 - ANA, rheumatoid factor.
 - Serum level angiotensin converting enzyme in sarcoidosis.
- 3- **Arterial blood gases:** typically show type 1 respiratory failure with hypoxemia and normal or low PCO_2 .
- 4- **Pulmonary function tests :** *show restrictive pattern*
 - Reduced lung volumes (e.g. vital capacity, total lung capacity)
 - Normal FEV1/FVC ratio.
 - Reduced gas transfer : reduced diffusing capacity for CO.
- 5- **Invasive method :**
 - Bronchoscopy with BAL : to diagnose the cause.
 - Lung biopsy : either transbronchial or open lung biopsy.

Treatment :

1. Treatment of the cause.
2. Cortisone and immunosuppressive therapy (*azathioprine or cyclophosphamide*) in idiopathic pulmonary fibrosis.
3. Antibiotic & Oxygen therapy may be needed.
4. Lung transplantation in advanced cases.

OCCUPATIONAL INTERSTITIAL LUNG DISEASES : (*Pneumoconiosis*)

The three most common types of occupational ILD are :

- I. Asbestosis.
- II. Silicosis.
- III. Coal worker's pneumoconiosis (CWP).

I. Asbestosis :

- ☠ Long history of asbestos exposure e.g. in construction, insulation, fireproofing, friction materials, ship building, electrical repair, carpentry, plumbing, and welding. ☺
- ☠ Clinical manifestations of ILD (*see above*)
- ☠ Pleural effusion.
- ☠ Bronchogenic carcinoma & mesothelioma.

II. Silicosis : caused by the prolonged inhalation of silica particles

- ☠ Clinical manifestations of ILD (*see above*)
- ☠ Patients with silicosis are at higher risk for TB.

III. Coal worker's pneumoconiosis : caused by the deposition of coal dust within the lung.There are 2 types :

- ☠ Simple pneumoconiosis : is usually asymptomatic with no associated clinical signs.
- ☠ Progressive massive fibrosis is usually associated with cough, productive of mucoid or blackened sputum, and breathlessness, and may lead to the development of cor pulmonale. Examination is unremarkable, with no clubbing and no crepitations.

Caplan's syndrome :

Miners with positive rheumatoid factor can develop large nodules. These occur on a background of simple pneumoconiosis and in those with a relatively low coal dust exposure.

Hamman-Rich syndrome :

Fulminant progressive variant of acute interstitial pneumonitis due to either interstitial pulmonary fibrosis or other causes leading to death with cor pulmonale or respiratory failure within 6 months.

Hypersensitivity Pneumonitis

(*Extrinsic allergic alveolitis*)

- Hypersensitivity pneumonitis is a cell-mediated immune reaction to inhaled antigens. Patients must be sensitized by an initial exposure, with subsequent re-exposure leading to acute or chronic hypersensitivity pneumonitis.
- Acute form often follows a short period of exposure to a high concentration of antigen, and is usually reversible. Chronic form typically follows a period of chronic exposure to a low antigen dose and is less reversible.
- **Causes** : Type III and IV hypersensitivity. *It is NOT an atopic disease, and is not characterized by a rise in tissue eosinophils or IgE (type I hypersensitivity)*

Antigen	Exposure	Syndrome
Chemical Isocyanates.	Paints	Chemical worker's lung
Animal Proteins Avian proteins Urine, serum, pelts	Bird droppings, feathers Rats, gerbils	Bird-fancier's lung Animal handler's lung
Microbial <i>Thermoactinomyces vulgaris</i> <i>Thermoactinomyces sacchari</i> <i>Aspergillus</i> spp	Moldy sugarcane Mushroom compost Moldy hay	Bagassosis Mushroom worker's lung Farmer's lung

- Clinical picture :

a) Acute form :

- Dyspnea, dry cough, and systemic symptoms (fever, arthralgia, myalgia, headache) occur 4-6 hours after exposure to antigen.
- Examination: Inspiratory crepitation.

b) Chronic form : the same as ILD.

- Investigations :

- Radiological infiltration.
- Pulmonary function tests : Restrictive pattern.
- Serum antibody (IgG) precipitin to suspected allergen.

- Treatment : Avoidance of suspected allergen, Cortisone.

SARCOIDOSIS

Definition :

Sarcoidosis is a multisystem granulomatous disorder of unknown etiology, most commonly affecting young adults. Granulomas most often appear in the lungs or the lymph nodes, but any organ can be affected.

Pathology :

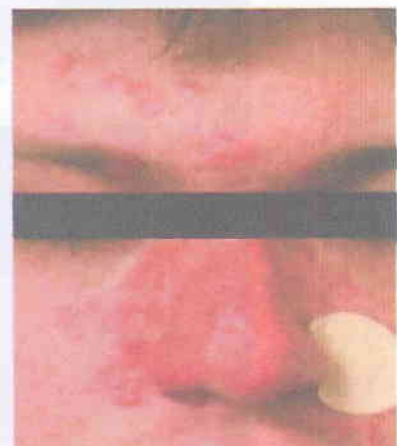
The characteristic granuloma composed of macrophages, lymphocytes with intracellular inclusion bodies.

Etiology :

- The exact cause of sarcoidosis is not known.
- Most probably due to alteration in immune response after exposure to antigenic stimulus (an environmental, occupational, or infectious agent).

Clinical picture :

1. It may be asymptomatic.
2. **Pulmonary** : dyspnea, cough, wheezing , may be hemoptysis.
3. **Upper airway** : nasal obstruction, hoarseness of voice.
4. **Lymphadenopathy** : painless, rubbery LN enlargement. The cervical & scalene lymph nodes are most frequently affected.
5. **Skin** :
 - Erythema nodosum (*red painful bumps on the anterior aspect of the leg*)
 - Lupus pernio : violaceous lesions on the nose & cheeks.
6. **Eye** : Anterior uveitis.
7. **Joints** : Polyarthritis.
8. **Cardiac** : Arrhythmia, congestive heart failure.
9. **CNS** : cranial neuropathy (facial nerve most often affected), diabetes insipidus.



Usual skin lesions in lupus pernio

10. **Renal** : ARF can be due to hypercalcemia & granulomatous interstitial nephritis.

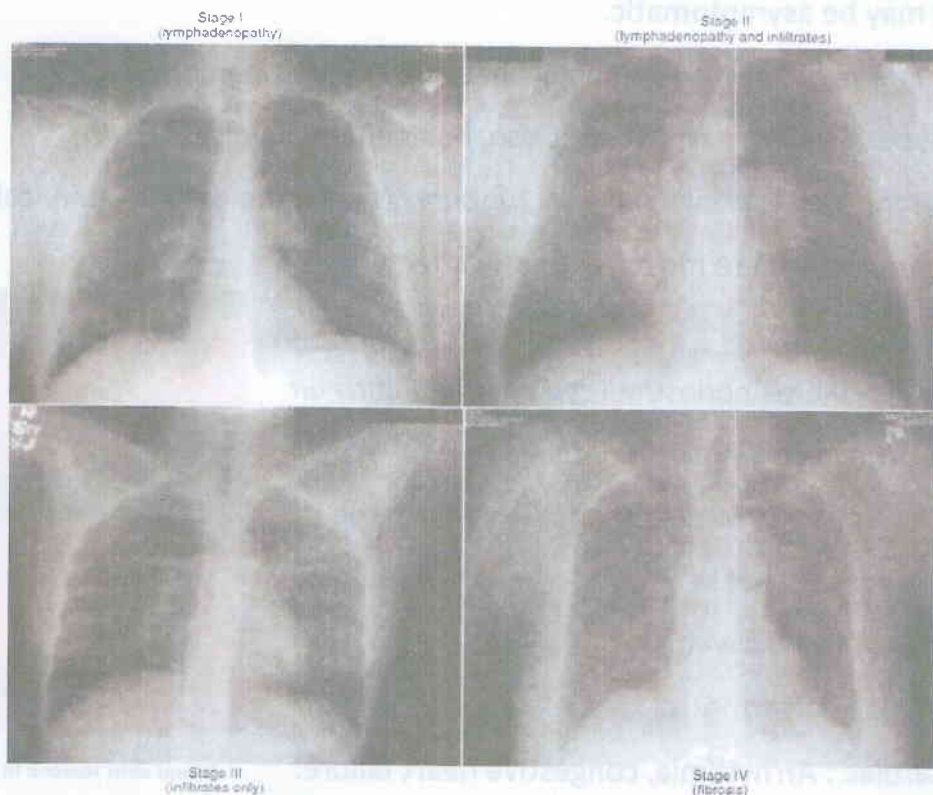
11. **Hypercalcemia** : due to excess production of vitamin D.

Investigations :

Chest X-ray :

Stage I	Bilateral hilar lymphadenopathy
Stage II	Bilateral hilar lymphadenopathy and pulmonary infiltration
Stage III	Pulmonary infiltration only
Stage IV	Fibrosis.

- The combination of bilateral hilar lymphadenopathy , erythema nodosum in association with fever & arthralgia is known as Lofgren syndrome.
- The main differential diagnosis are TB & lymphoma, and every effort should be made to confirm the diagnosis of sarcoidosis histologically (Lung ,LN or skin biopsy).



Treatment :

1. Cortisone is the main therapy.
2. Others : methotrexate, chloroquine.
3. Lung transplantation in advanced cases.

Prognosis :

- Good prognosis Lofgren's syndrome has complete resolution in **80%** of people.
- Poorer prognosis with chronic disease Lupus pernio, nasal mucosa involvement, chronic uveitis, chronic hypercalcaemia, nephrocalcinosis, neural involvement, age greater than **40** and Black race.
- Prognosis according to chest X-ray :
 - ✓ **Stage II** : **50%** cases recover spontaneously in **2** years, **30 - 40%** require systemic steroids, **10 - 15%** require long-term steroids.
 - ✓ **Stage III** : Worse prognosis. Only **30%** show significant improvement with steroids.

LUNG COLLAPSE

(Atelectasis)

Definition :

- **Collapse** : acquired deflation of the previously inflated lung.
- **Atelectasis** : Incomplete expansion of the lung at birth.

The 2 terms are used interchangeable

Causes of atelectasis :

1. Prematurity → Hyaline membrane disease → ↓ surfactant (see below)
2. Congenital bronchial obstruction.
3. Respiratory center depression by sedatives given to the mother.

Causes & types of collapse :

I. Obstruction collapse : (absorption collapse)

Bronchial obstruction ⇒ absorption of air in the corresponding area of lung tissue.

(The oxygen is absorbed into the blood at a faster rate than it is replaced)

- Intra luminal : Foreign body, secretions.
- Wall : Bronchostenosis, tumor.
- Outside : Enlarged LN or mediastinal mass.

II. Non-obstruction collapse :

1- Compression collapse : (Syn: pressure, passive or relaxation collapse)

Here there is something presses on the lung e.g. Pleural effusion, Pneumothorax.

2- Adhesive collapse : Collapse due to abnormal lung surfactant.

Lung surfactant is a lipoprotein secreted by the alveolar epithelium and its function is to reduce the surface tension of fluids lining the alveoli → overcome the normal tendency of the lung to collapse. So, its absence leads to alveolar collapse.

- Hyaline membrane disease (Neonatal respiratory distress syndrome) : usually occurs in premature infants.
- Adult respiratory distress syndrome.

3- Cicatrization collapse : (collapse due to pulmonary fibrosis)

Fibrosis → stiffness of the lung → ↓ lung compliance → the volume of the affected lung is reduced.

Clinical picture :

Symptoms :

1. Dyspnea.
2. Cough.
3. Clinical picture of the cause.

Signs :

1. Inspection :

- Diminished movement on the affected side.
- Chest wall retraction on the affected side.

2. Palpation :

- Diminished TVF
- Mediastinal shift to the affected side.

3. Percussion :

- Dullness over the affected side.

4. Auscultation :

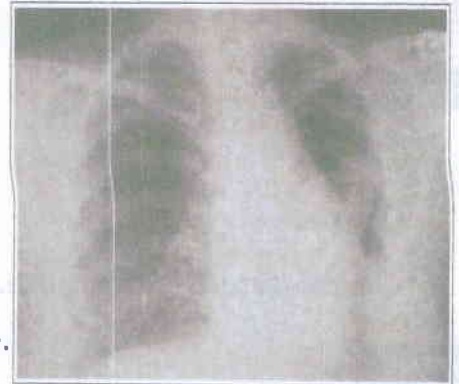
- Diminished breath sound intensity.

Complications :

1. Recurrent pneumonia and lung abscess.
2. Fibrosis.
3. Bronchiectasis.
4. Respiratory failure.

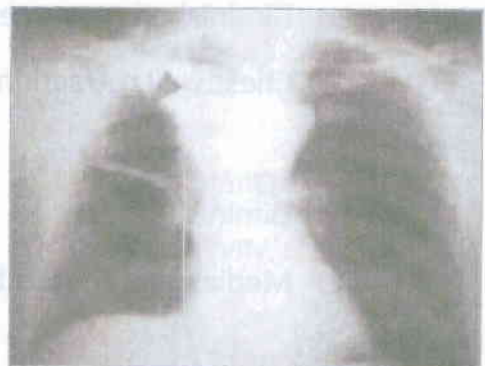
Investigations :**1- Radiology :****Chest X-ray :**

- Area of homogenous opacity over the affected lobe.
- Displacement of fissures.
- Crowding of bronchi.
- Raised diaphragm.
- Crowding of ribs.
- Mediastinal shift towards the side of collapse.
- Hilum shift up or down towards the side of collapse.
- Compensatory hyperinflation of the normal lung.



Chest x-ray showing collapsed left lung

Right upper lobe collapse. Increased shadowing in the right upper zone with a clear linear border of the horizontal fissure which has been pulled up (arrowhead). Note the remaining right lung is blacker than the opposite side. In addition the hilum is pulled up. There is a mass arising from the right hilum (arrow)

**2- Bronchoscopy :**

- Diagnostic to detect the cause (foreign body or tumor).
- Therapeutic to remove foreign body or secretions.

3- Investigations for the cause & for complications : e.g. High resolution CT.**Treatment :**

1. Treatment of the cause.
2. Bronchoscopic removal of FB or secretions.
3. Breathing exercise.
4. O₂ therapy.
5. Prophylactic antibiotics.

Acute post operative massive collapse**Etiology :**

- ☠ Lack of good preoperative preparation.
- ☠ General anesthesia in presence of chest infection.
- ☠ Neglected aspiration of secretions during & after surgery.
- ☠ Inadequate cough or chest expansion post operatively due to pain.
- ☠ Aspiration of vomitus due to full stomach at time of anesthesia.

Clinical picture :

- Symptoms : Sudden onset (24-72 h after operation) of **dyspnea**, cough, wheezy chest.
- Signs : The same as collapse.

Investigations : as collapse.**Treatment :**

- Prophylactic : avoid predisposing factors.
- Therapeutic : as collapse.

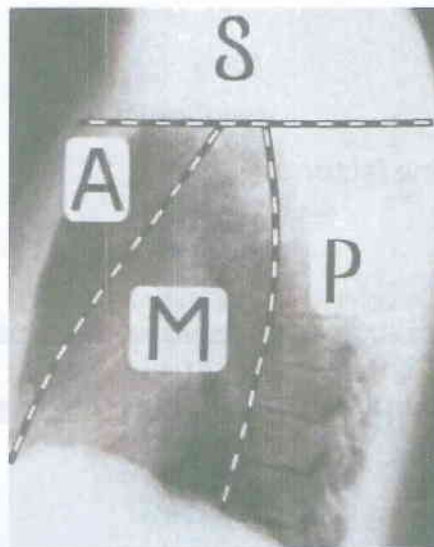
Post operative pulmonary complications : (causes of dyspnea after operation)

- ✓ Aspiration pneumonia.
- ✓ Aspiration lung abscess.
- ✓ ARDS.
- ✓ Pulmonary embolism.
- ✓ Postoperative collapse.
- ✓ Pneumothorax.

THE MEDIASTINUM

Anatomy :

- It is the area of the thorax that lies between the two pleural cavities.
- **Boundaries :**
 - **Anteriorly :** Sternum.
 - **Posteriorly :** Vertebral column.
 - **Superiorly :** Thoracic inlet.
 - **Inferiorly :** Diaphragm.
 - **On each side :** Mediastinal pleura.



- **Divisions :** The mediastinum is divided into the following parts :
 - a) **Superior mediastinum :** is separated from the inferior by an imaginary plane passing from the sterna angle anteriorly to the lower border of the body of 4th thoracic vertebra posteriorly.
 - b) **Inferior mediastinum :** is subdivided into 3 parts :
 - i. **Anterior mediastinum :** in front of the pericardium.
 - ii. **Middle mediastinum :** pericardium & its contents.
 - iii. **Posterior mediastinum :** behind the pericardium.

○ **Contents :****A. Superior mediastinum :****Tubes :**

1. Esophagus : most posterior structure.
2. Trachea : in front of the esophagus.
3. Thoracic duct.

Vessels :

4. Arch of the aorta & its 3 branches (*brachiocephalic, left common carotid & left subclavian*)
5. Superior vena cava & its 2 brachiocephalic (*innominate*) veins.

Nerves :

6. Right & left phrenic, 2 vagi & left recurrent laryngeal nerve.

B. Anterior mediastinum : Thymus gland.**C. Middle mediastinum :**

1. Heart & pericardium.
2. Arteries : Ascending aorta & pulmonary artery.
3. Veins : Lower half of SVC, part of azygos vein & inferior vena cava.
4. Nerves : phrenic nerve.
5. Tubes : Lower part of trachea & its bifurcation.

D. Posterior mediastinum :

1. Artery : Descending aorta.
2. Veins : Azygos and hemiazygos veins.
3. Nerves : Vagi and splanchnic nerves.
4. Tube : Esophagus, thoracic duct.

NB*All components contain LN, connective tissue & lymphatics.*

Diseases that affect the mediastinum :

- ☠ Inflammation : mediastinitis.
- ☠ Fibrosis.
- ☠ Pneumomediastinum.
- ☠ Mediastinal masses : benign or malignant.

Causes of mediastinal masses :

Anterior mediastinal masses : 4 Ts

- ☠ **T**hymoma.
- ☠ **T**hyroid swelling.
- ☠ **T**errible lymphoma.
- ☠ **T**eratoma.

Middle mediastinal masses : A, B, C

- ☠ **A**ortic aneurysm.
- ☠ **P**ericardial effusion.
- ☠ **B**ronchogenic carcinoma.
- ☠ **C**ardiomegally.

Posterior mediastinal masses :

- ☠ Neural tumor e.g. neurofibroma, neuroblastoma & paraganglioma. 🎵 🎵 ☹
- ☠ Esophageal tumors.
- ☠ Descending aortic aneurysm.
- ☠ Posterior diaphragmatic hernia.

Superior mediastinum :

- ☠ Aortic aneurism.
- ☠ Retrosternal goiter.
- ☠ Thymoma.
- ☠ Esophageal tumors.

Clinical picture of mediastinal masses :

1- Asymptomatic : 30 – 50 % of cases are asymptomatic.

2- Pressure manifestations : due to compression on the following structures :

3 Tubes :

- Trachea : Dyspnea, Brassy cough.
- Esophagus : Dysphagia.
- Thoracic duct : Chylous effusion.

3 Vessels :

- SVC : Congested non pulsating neck vein, collaterals on the chest wall, edema of the face.
- Azygos vein : Engorged veins on the upper part of the chest.
- Aorta : Ischemic pain, Unequal pulse of upper limbs.

SVC is vulnerable to obstruction because :

- ✓ It is thin walled.
- ✓ Its intravascular pressure is low.
- ✓ It is confined to LN and other relatively more rigid structures.

3 Nerves :

- Left recurrent laryngeal nerve : Hoarseness of voice.
- Sympathetic chain : Horner's syndrome.
- Phrenic nerves : Hiccup, diaphragmatic paralysis.

3 Bones :

- Ribs : Rib erosion with pain.
- Vertebra : Pain.
- Sternum : Pain.

3- Clinical manifestations of the cause : e.g.

- Thymoma :**
- Myasthenia gravis.
 - Red cell aplasia.
 - Myocarditis

4- Pneumomediastinum :

- It is the presence of air in the mediastinum.
- Etiology :
 - ✓ Alveolar rupture with dissection of air into the mediastinum.
 - ✓ Perforation or rupture of the esophagus, trachea, or main bronchi.
- Clinical picture :
 - ✓ Typically, there is severe substernal chest pain due to stretching of the mediastinal structures.
 - ✓ The physical examination usually reveals subcutaneous emphysema in the suprasternal notch and *Hamman's sign*, which is a crunching or clicking noise with the heartbeat and best heard in the left lateral position.
- The diagnosis is confirmed with the chest X-ray.
- Treatment :
 - ✓ Usually no treatment is required.
 - ✓ If mediastinal structures are compressed, the compression can be relieved with needle aspiration.

5- Acute mediastinitis :

- It is a life threatening condition.
- Etiology :
 - ✓ Esophageal perforation : e.g. as a complication of esophagoscopy or the insertion of a Blakemore tube.
 - ✓ Cardiac surgery.
- C/P : Dramatic chest pain, dyspnea with fever due to the mediastinal infection.
- Treatment : antibiotics and surgical drainage.

Investigations of a case with mediastinal mass :

1. Chest X-ray.
2. CT & MRI.
3. Contrast studies (*in certain situations*)
 - Barium swallow.
 - Angiography.
4. Bronchoscopy & biopsy if needed.
5. Scalene node biopsy.
6. Radioactive Iodine uptake for thyroid swelling.

Treatment of mediastinal masses :

- a) All mediastinal masses whether benign or malignant must be surgically removed because :
 - They may enlarge and compress mediastinal structures.
 - Bleeding, rupture or infection.
 - Malignant degeneration.
- b) Treatment of the cause.

If you can't explain it simply, you don't understand it well enough.

Albert Einstein

DISEASES OF CHEST WALL

1- Kyphoscoliosis :

Kyphoscoliosis is a combination of excessive anteroposterior angulation (kyphosis) and lateral curvature of the thoracic spine (scoliosis).

Causes :

- a. **Idiopathic** (80%)
- b. Neuromuscular disease : muscular dystrophy, poliomyelitis.
- c. Connective tissue disease : Marfan's syndrome.
- d. Vertebral diseases : Rickets, TB spondylitis.

Pathophysiology :

The major pathophysiologic effects of severe kyphoscoliosis are restrictive lung disease and ventilation-perfusion mismatch → hypoxic vasoconstriction, and eventually pulmonary hypertension and cor pulmonale.

Clinical picture :

- Asymptomatic.
- Dyspnea.
- Recurrent infection.
- Respiratory failure & hypoxic cor pulmonale.

NB

The severity of the cardiopulmonary disease correlates roughly with the degree of scoliosis. If the angle of curvature is $< 60^\circ$, ventilator impairment is rare, while if it is $> 90^\circ$, marked ventilatory abnormalities develop commonly.

Radiology :

Lateral and/or posterior angulation of thoracic vertebrae with fanning of the joining ribs.

Treatment :

- Oxygen therapy & physical training.

- Antibiotic for recurrent infection.
- Mechanical ventilation if complicated by respiratory failure.
- Surgical correction of the deformity.

2- Pectus excavatum : (*Funnel chest*)

Depression of the sternum (lower end or whole length).

Causes :

- a) Congenital.
- b) Associated with : **Marfan's syndrome**, **Mitral valve prolapsed**.

Clinical picture :

- Asymptomatic : in mild cases.
- Respiratory failure & hypoxic cor pulmonale.
- May displace the heart producing heart failure & laterally shifted apex.

Treatment : surgical correction if it is severe.

3- Pectus carinatum : (*Pigeon chest*)

Prominence of the sternum & adjacent costal cartilage.

Causes :

- Congenital.
- Chronic respiratory distress in childhood e.g. bronchial asthma.
- Rickets.

4- Barrel shaped chest : (*Fixed inspiratory position*)

- Increased antero-posterior diameter (becomes equal or more than lateral diameter)
- Ribs are less oblique than normal.
- Wide subcostal angle & wide interspaces.
- Causes : hyperinflated chest e.g. emphysema.

DISEASES OF DIAPHRAGM

1- Diaphragmatic paralysis :

Causes : any cause that damage the phrenic nerve

- a. Traumatic :
 - Surgical : accidental during neck or thoracic operations. (unilateral)
 - Non-surgical : cervical spine or birth injury.
- b. Tumors : bronchogenic carcinoma, cancer thyroid.
- c. Neurological : herpes zoster, myelitis, encephalitis.
- d. Congenital (*eventration of the diaphragm*) : condition in which all or part of the diaphragm is composed of fibrous tissue with only a few or no muscle fibers.

Clinical picture :

- Cause.
- Dyspnea : due to encroachment on the vital capacity.
- Reversed tidal percussion.
- Paradoxical abdominal movement.

Investigations : Chest X-ray, confirmed by fluoroscopy.

Treatment :

- Treatment of the cause.
- O2 therapy, mechanical ventilation.

2- Diaphragmatic hernia :

Herniation of abdominal organ through the diaphragm into the thorax.

Causes :

- a) Congenital : it occurs through
 - Para-esophageal hiatus.
 - Inferior vena cava or aortic orifice.
- b) Traumatic : blunt trauma to the chest.

Clinical picture :

- Asymptomatic : discovered accidentally on chest X - ray.
- Dyspnea or chest pain.
- If it occurs on the left side it will lead to positional dysphagia & dyspepsia.

Treatment : surgical repair.

3- Infection of the diaphragm :

- Subphrenic abscess may occur spontaneously or due to perforation of a viscus.
- C/P : Costal & subcostal pain, unexplained fever.
- Chest X-ray : elevated hemithorax, pleural effusion & air fluid level.
- Treatment : surgical evacuation.

4- Involuntary movement of the diaphragm : (Hiccup, Hiccough)

- Sudden inspiratory spasm of the diaphragm with associated closed glottis.
- Causes : Gastric distension, Pericarditis, mediastinitis, Uremia.
- Treatment : chlorpromazine.

5- Tumors of the diaphragm :

Extremely rare, benign tumors are commoner than malignant tumors.

I have not failed. I've just found 10,000 ways that won't work.

Thomas Edison

PULMONARY HYPERTENSION

Definition :

Elevation of the pulmonary arterial pressure above $\frac{35}{17}$ mmHg.

Etiology :

Primary pulmonary hypertension (PPH) :

- Very rare (represents less than 1 % of all cases of pulmonary hypertension).
- Etiology is **unknown** , occurs more commonly in middle aged female with repeated pregnancies.
- May be due to repeated thromboembolism , pulmonary vasculitis.

Secondary pulmonary hypertension :

1- Hyperdynamic pulmonary hypertension :

Due to increased pulmonary arterial blood flow :

- ✗ Hyperdynamic circulation.
- ✗ Congenital heart diseases : ASD , VSD , PDA .

2- Passive pulmonary hypertension :

Due to pulmonary congestion : ✗ Mitral valve disease . ✗ LSHF .

3- Vasoconstrictive (reactive) Pulmonary hypertension :

Due to reflex VC of pulmonary arteriole in response to :

- ✗ Long standing pulmonary congestion.
- ✗ Long standing hyperdynamic pulmonary hypertension .
- ✗ Hypoxia : COPD .

4- Obstructive pulmonary hypertension :

Long standing vasoconstrictive pulmonary hypertension → Irreversible VC of pulmonary arterioles.

5- Acute obstructive pulmonary hypertension :

Massive pulmonary embolism .

Clinical picture :

- 1- C/P of the cause .
- 2- Right ventricular enlargement .
- 3- RSHF .
- 4- **Signs of pulmonary hypertension :**

✎ **General :** Giant "a" wave . (no giant "a" wave in ASD ??)

✎ **Cardiac :**

- Inspection : Pulsation in the 2nd left intercostals space .
- Palpation : Diastolic shock (*palpable accentuated pulmonary component of S₂*)
- Percussion : Dullness in the 2nd left intercostals space .
- Auscultation :
 - Accentuated S₂ .
 - Wide splitting S₂ .
 - S₄ .
 - Ejection click .
 - Ejection systolic murmur : due to relative PS .
 - Early diastolic murmur : due to relative PR .

Investigations :**X ray :**

- Dilated pulmonary artery .
- RVE .

ECG :

- Peaked P wave (P pulmonale) .

Echo :

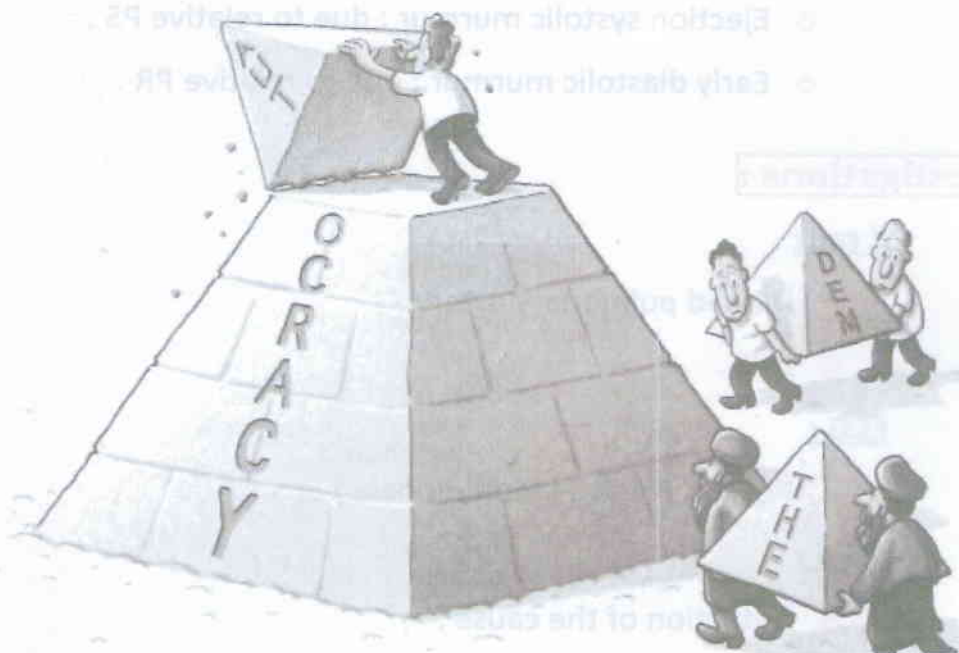
- Detection of the cause .
- Estimation of the pulmonary artery pressure .
- RVE .

Catheterization :

- Detection of the cause .
- Estimation of the pulmonary artery pressure .
- RVE .

Treatment :

- Treatment of the cause .
- Treatment of RSHF .
- Drugs : (*limited benefit*)
 - ACE inhibitors , Anticoagulants .
 - PGI₂ . (*potent systemic & pulmonary vasodilator*)
 - Ca channel blockers .
 - Diuretics .
- Heart lung transplantation : is the chief therapeutic option .



Etiology : (source of emboli)

- Predisposing factors of DVT : (Virchow triad)
 - i. Slow circulation.
 - ii. Injury of endothelium.
 - iii. Hypercoagulability.

- ~~X~~ **O**perative : especially pelvic & bone surgery .
- ~~X~~ **O**nco**l**ogy : Cancer stomach , leukemia & lymphoma .
- ~~X~~ **O**ld age .
- ~~X~~ **O**ral contraceptive pills ~~X~~ **O**besity.
- ~~X~~ **O**thers : 2 "**C**" - Congestive heart failure
- Coagulation disorders : protein C & S deficiency .

Infective endocarditis , Atrial fibrillation , Myocardial infarction.

4- Rare : Fat embolism , Air embolism , Amniotic fluid embolism .

- Unfortunately, there are no clinical or laboratory findings that will confirm or exclude the diagnosis of pulmonary embolism .
- The clinical picture of pulmonary embolism is not specific , so successful management of pulmonary embolism requires a combination of clinical suspicion & appropriate use of diagnostic tools .

- The clinical presentations are ranging from asymptomatic to sudden death depending on the size of the embolus .

1- **Small sized emboli :**

- Recurrent small pulmonary emboli results in occlusion of large number of pulmonary arterioles.
- Usually asymptomatic , but non specific symptoms of tachypnea , dyspnea, tachycardia or pleuritic chest pain may occur .
- May result in the development of pulmonary hypertension & subacute cor pulmonale over years .

2- **Medium sized emboli** (*pulmonary infarction*) : occlusion < 60% of the vascular bed.

C/P : 🖐️

- ✂️ Pleuritic chest pain.
- ✂️ Cough & hemoptysis.
- ✂️ Dyspnea .

3- **Acute massive pulmonary embolism** : occlusion > 60% of the vascular bed

- Acute dyspnea .**
- Acute chest pain :** (*similar to angina pain*) due to :
 - Distension of the pulmonary artery .
 - Reflex coronary spasm .
- Sudden appearance of pulmonary hypertension .**
- Acute right sided heart failure .** (*see HF*)
- Shock :** It is an obstructive shock in which there is marked ↓ of blood flow to the lung → ↓ blood flow to left atrium → ↓ COP → shock .
- Sudden death :** may be the first manifestation if occlusion involves more than 80% of the vascular bed .
- Finding suggestive for DVT :** Tenderness , swelling , redness of the LL .
unfortunately, DVT of the leg is often clinically silent .

Differential diagnosis :**Causes of acute dyspnea with acute chest pain :**

- 1- Pulmonary embolism .
- 2- Myocardial infarction .
- 3- Pericardial effusion .
- 4- Acute pulmonary edema (acute heart failure) .
- 5- Pneumonia .
- 6- Tension pneumothorax .
- 7- Bronchial asthma .

Clinical & Lab findings in patients with suspected pulmonary embolism : *Not to memorize*

Findings	+ve predictive value	-ve predictive value
Dyspnea	37 %	75 %
Tachycardia	47 %	86 %
Pleuritic chest pain	39 %	71 %
Hemoptysis	32 %	67 %
Hypoxemia	34 %	70 %
Elevated plasma D - dimer	27 %	92 %

+ve predictive value : It expresses the likelihood that a PE is present when the finding is present.

-ve predictive value : It expresses the likelihood that a PE is not present when the finding is also not present.

The ICU Book, 3rd edition 2007 Paul Marino

Investigations :**1- Chest x ray :**

- Normal in most cases .
- Elevated cupola of the diaphragm.
- Pleural effusion .
- Pulmonary infarction : wedge shaped opacity .
- Dilated pulmonary artery with decreased pulmonary vasculature
(Westermark sign)
- **Hypoxia with a normal x ray should raise the possibility of PE .**

2- ECG :

- May be normal .
- Sinus tachycardia & atrial fibrillation .
- $S_1 Q_3 T_3$ pattern (*S wave in lead I , Q wave in lead III & an inverted T in lead III*)
- The most important value is to exclude MI as a cause of dyspnea & chest pain.

3- Echo : Enlargement of RA , RV & pulmonary artery .

4- Pulmonary angiography : is the gold standard for making a diagnosis .

5- Spiral CT angiography : less invasive than standard angiography .

6- Ventilation – perfusion scan : Areas of normal ventilation & hypoperfusion .

7- Laboratory :

- Arterial blood gases : hypoxia , hypocapnia .
- Elevated serum LDH .
- D – Dimer : (*an end product of fibrin digestion*)

It is a good –ve test : if D-dimer is not elevated , PE is unlikely.

8- Investigation for diagnosis of DVT : Duplex ultrasound .

Treatment of pulmonary embolism & DVT :
I- Prophylaxis :

1. Early post operative ambulation .
2. Elastic stocking .
3. Elevation of the leg .
4. Anticoagulants in high risk patients : *for about one week*
 - ✗ Low dose heparin 5000 units SC / 8-12 hr .
 - ✗ Low Molecular Weight heparin (enoxaparine : Clexane) 20-40mg/d.

II- Curative :

- 1- Hospitalization in CCU .

2- Anticoagulants :

➤ Heparin :

- Mechanism of action : activation of antithrombin III .
- 5000 – 10000 units IV as a loading dose then ,1000 units /h (infusion)
- Duration : for about one week or till clinical improvement .
- Follow up: by estimation of PTT, should be maintained twice the normal
- Antidote : protamine sulphate IV .

➤ LMW heparin :

1mg/kg SC/12 h. No need for routine anticoagulant monitoring.

➤ Oral anticoagulant : warfarin (Marevan)

- Mechanism of action : Competes with vitamin K → ↓ formation of coagulation factors II , VII , IX & X .
- Dose : 2-10 mg/d . It is determined according to the PT .
- Because of the delayed onset of action , it is started 3 days before discontinuation of heparin & is continued for at least 3 months & for life in recurrent cases .
- Warfarin should never be used in pregnancy .

3- Thrombolytic therapy : Streptokinase , tPA

Indicated in life threatening massive pulmonary embolism when the patient is hemodynamically unstable (RSHF or shock)

4- Pulmonary embolectomy :

It is used for those with massive PE when thrombolysis is contraindicated.

5- Symptomatic treatment :

- Pain : Analgesics e.g. pethidine (avoid morphine)
- Dyspnea : Oxygen inhalation & mechanical ventilation in severe cases .

6- Treatment of complications :

- Shock

- RSHF .

7- Inferior vena caval filters : e.g. Greenfield filter

- Meshlike filter can be placed in the inferior vena cava to trap emboli & prevent them from traveling to the lungs .
- Should be considered when anticoagulants are contraindicated .

COR PULMONALE**Definition :**

Cor pulmonale is right ventricular enlargement with or without failure resulting from pulmonary disease after exclusion of LSHF & congenital heart diseases .

Pulmonary disease → Pulmonary HTN → RV enlargement → RSHF.

Etiology :**1- Acute cor pulmonale :**

- Acute massive pulmonary embolism .
- Acute massive lung collapse .
- Tension pneumothorax .

2- Subacute cor pulmonale :

- Recurrent small pulmonary embolization.
- Lymphangitis carcinomatosa of the lung .

3- Chronic cor pulmonale :

- Parenchymal lung diseases : **COPD** , **IPF** .
- Pulmonary vascular diseases : **Bilharziasis** , primary pulmonary hypertension.
- Thoracic wall diseases : kyphoscoliosis , Pickwickian syndrome .

Clinical picture , investigations , treatment : 4

- Of the cause : Bilharziasis : see GIT book p 50 , COPD : see chest .
- Of pulmonary hypertension .
- Of RV enlargement : may be masked by emphysema in a case of COPD .
- Of RSHF .

OXYGEN THERAPY

- Oxygen therapy is the delivery of any oxygen concentration greater than 21%.
- Oxygen, like any drug, has indications, dose, complications & toxic manifestations.

Indications :

1. Correction of hypoxic hypoxia : (*highly beneficial*)

e.g. pulmonary disorders (e.g. COPD), shunting of venous blood into arterial blood.

- The standard indications for supplemental oxygen are an arterial PO_2 (PaO_2) $\leq$ 60 mmHg or an arterial O_2 saturation (SaO_2) $< 90\%$.
- Signs of respiratory distress.

2. Anemic hypoxia : Improvement of oxygenation in a case of decreased O_2 carrying capacity e.g. anemia.

3. Stagnant hypoxia e.g. heart failure. (*less beneficial*)

4. Oxygen therapy is NOT beneficial in histotoxic hypoxia e.g. cyanide poisoning.

The dark side of oxygen :

a. Hypoventilation :

Due to reversal of the respiratory stimulatory effect of hypoxemia.

b. Absorption atelectasis :

Breathing of high concentration of oxygen → replacement of nitrogen in the alveoli

→ The alveolar oxygen is then absorbed into the pulmonary capillary → collapse.

c. Pulmonary oxygen toxicity : (*related to the duration of exposure & O_2 concentration*)

Prolonged inhalation of oxygen produce cell injury via the production of toxic

metabolites. (O_2 free radicals are capable of oxidizing cell membrane & enzymes)

- Acute tracheobronchitis : dry cough.
- Acute respiratory distress syndrome (ARDS)
- Headache, malaise, anorexia.

d. Retro-lental fibroplasias : (*retinopathy of prematurity*)

It is seen in some premature infants with respiratory distress syndrome who are treated with pure O₂ → VC of retinal vessels → retinal detachment, and possible blindness.

Methods of oxygen inhalation :

I. Low-flow system : devices that give flow less than minute ventilation of the patient.

- Nasal canula (*Nasal prongs*).
- Simple face mask.
- Masks with reservoir bags : (partial rebreather, Nonrebreather)

II. High-flow system :

Devices that give flow more than minute ventilation of the patient (*delivering oxygen at flow rate that exceed the patient's peak inspiratory flow rate*)

- Venturi mask.
- Manual resuscitation bags (MRBs).

Low-flow system :

Nasal canula : (nasal prongs)

- Nasal canula is capable of delivering an FiO₂ (fraction of inspired oxygen = concentration of inhaled oxygen) ranging from 24% to 44% depending on the flow rate.
- The oxygen flow rate through nasal canula is 1 – 6 L/min.
- Advantages :
 - Easy to use & allow eating & taking.
- Disadvantages :
 - ☠ Inability to achieve high concentration of inhaled oxygen.
 - ☠ The exact FiO₂ delivered is not accurate.
 - ☠ Irritation of nasal mucosa.

Simple face mask :

- Standard face masks deliver oxygen at flow rates between **5 – 10 L/min**.
- Face masks can provide a slightly higher maximum FiO_2 than nasal canula (up to 60%). However, this difference can be small & insignificant.

Masks with reservoir bags :

- Similar to simple face masks, with addition of an oxygen reservoir bag.
- There are 2 types : (partial rebreather, Nonrebreather)
- Advantages :
 - ✓ Partial rebreather devices : provide higher FiO_2 (**70 – 80%**).
 - ✓ Nonrebreather devices : provide pure oxygen (FiO_2 **100%**)
- Disadvantages :

Masks can be uncomfortable, need to be removed during eating. Aerosolized bronchodilator therapy is also not possible.

High-flow system :**Venturi mask :**

It delivers oxygen most accurately and up to FiO_2 of **60%** which can be adjusted as needed.

Manual resuscitation bags : (MRBs)

- MRBs consist of self inflating bag & are used to provide oxygen and positive pressure ventilation to a sealed airway such as a mask, endotracheal tube.
- MRBs are indicated for both oxygenation and ventilation of patients who have inadequate or absent spontaneous respiration in an arrest situation.

Advantages of high-flow systems :

The major advantage is the ability to deliver a constant FiO_2 . This feature is important in patients with chronic hypercapnia because there is small risk that supplemental oxygen will worsen alveolar ventilation and can lead to further CO_2 retention.

In the hypercapnic hypoxemic patient : therapy should begin with FiO_2 of 24% to 28% by nasal canula or mask (Venturi is most accurate mask). If the PaO_2 is still less than 55 mmHg after 30 minutes, increase oxygen flow incrementally and measure arterial blood gases every 30 minutes for the first 1 to 2 hours or until PaO_2 of at least 55 mmHg is being achieved and CO_2 narcosis is not developing.

A final word

- The goal of oxygen administration is to facilitate adequate uptake of oxygen into the blood to meet the needs of peripheral tissues.
- Increase in arterial PO_2 during oxygen inhalation should not be used as evidence for an increase in tissue oxygen availability. ***This is consistent with the observation that oxygen inhalation does not protect against myocardial infarction.*** It is explained by the tendency of oxygen to reduce systemic blood flow.

There are 2 mechanisms for this effect :

- i. First, oxygen acts as vasoconstrictor in all vessels except the pulmonary vessels (where it acts as vasodilator).
 - ii. Second, oxygen inhalation is often associated with a decrease in cardiac output. due to -ve inotropic effect on the heart.
- Finally, more attention must be given to the antioxidant status of individual patients to assess the risk of pulmonary oxygen toxicity.

MECHANICAL VENTILATION

- Mechanical ventilation may decrease respiratory work & improve arterial oxygenation with improved tissue oxygen delivery.
- Ventilatory support may be :
 1. **Invasive** : *via endotracheal tube or tracheostomy.*
 2. **Non-invasive** : *via facemask .*
- Positive pressure ventilators : (work by increasing the patient's airway pressure)
 - CPAP : where IPAP = EPAP
 - BiPAP : where IPAP > EPAP

Terminology used in the field of mechanical ventilation :

- BiPAP: Bilevel Positive Airway Pressure
- CPAP : Continuous positive airway pressure
- EPAP : Expiratory positive airway pressure
- IPAP : Inspiratory positive airway pressure

Indications :

1. Acute lung injury (ARDS, trauma).
2. Apnea with respiratory arrest.
3. Respiratory failure :
 - Severe dyspnea, confusion or coma despite initial medical treatment and oxygen therapy.
 - Severe worsening hypercapnia ($\text{PaCO}_2 > 70 \text{ mmHg}$).
 - Persistent hypoxemia ($\text{PaO}_2 < 50 \text{ mmHg}$).
 - Severe worsening respiratory acidosis ($\text{pH} < 7.25$)
 - Respiratory rate > 35.
4. Circulatory failure e.g. pulmonary edema.

Complications :

- 1) **Barotrauma** : High airway pressures may damage airway epithelium, leading to ventilator-induced lung injury (alveolar distension & rupture → pneumothorax)
- 2) **Hypotension & organ hypoperfusion** :
Positive-pressure ventilation can result in decreased COP and BP by decreasing venous return and concurrent administration of sedative agents.
- 3) **Ventilator-associated pneumonia.**
- 4) **Fluid retention & hyponatremia** :
Often develop from several factors, including humidification of inspired gases, administration of hypotonic fluids and diuretics, and increased levels of circulating antidiuretic hormone.
- 5) **Oxygen toxicity** : when an FIO₂ of > 60% is administered, particularly for more than 48 hours.

Invasive ventilation :

This requires tracheal intubation and includes :

- IPPV : Intermittent positive pressure ventilation.
- CPAP : Continuous positive airway pressure given via endotracheal tube.
- SIMV : Synchronized intermittent mandatory ventilation.
- HFJV : High frequency jet ventilation.

DYSPNEA

Definition :

Awareness or difficulty of breathing.

Etiology :

CVS : Any left sided heart disease $\Rightarrow$ lung congestion.

LSHF , MS , MR , AS , AR , myocardial infarction

Chest : All chest diseases

- Chest wall : obesity , Kyphoscoliosis ...
- Bronchial : COPD , bronchial asthma
- Pleural : pleurisy , pleural effusion
- Pulmonary circulation diseases : pulmonary embolism , pulmonary hypertension.

CNS :

Increased ICT $\Rightarrow$ $\uparrow$ of respiratory center.

Abdominal : $\uparrow$ of intra abdominal pressure.

Pregnancy , Ascites , HSM

Metabolic : Any acidosis

DKA , Lactic acidosis , Uremic acidosis ...

Pathogenesis of cardiac dyspnea : 7

- 1- Decrease in the vital capacity due to increase the amount of blood present in the lungs.
- 2- Exaggeration of Hering-Breuer reflex due to rigid alveoli.
- 3- Churchill-Cope reflex : It occurs in pulmonary congestion which leads to stimulation of respiratory center.
- 4- Fatigue of respiratory muscle due to LCOP.
- 5- Pulmonary edema $\Rightarrow$ non functioning alveoli.
- 6- Pleural & pericardial effusion lead to mechanical compression of the lungs.

7- Hypoxia $\Rightarrow$ stimulation of respiratory center.

Grades of dyspnea : New York Heart Association (NYHA)

- Grade I : Dyspnea on extra ordinary effort.
- Grade II : Dyspnea on ordinary effort.
- Grade III : Dyspnea on less than ordinary effort .
- Grade IV : Dyspnea even at rest.

Orthopnea :

- Dyspnea on lying flat , partially relieved by sitting.
- This occurs due to :
 - Increased venous return which increases the lung congestion.
 - Elevation of diaphragm.
- No one can blame me when I say that orthopnea is not specific to cardiac diseases , It also may occur due to chest or abdominal causes.

Paroxysmal Nocturnal Dyspnea (PND) :

- Attacks of dyspnea & cough with frothy expectoration occurring during night 1 – 2 hours after sleep & after a few minutes the patient feels better & goes back to sleep.
- If the condition is accompanied with chest wheezes , it is called cardiac asthma.
- Cardiac asthma is a state of impending pulmonary edema.
- PND is a specific symptom of left sided heart lesion especially LSHF.
- Pathogenesis of PND : During sleep , there are :
 - i- Vagal predominance $\Rightarrow$ causes further weakness of the contraction of left ventricle.
 - ii- Absorption of edema fluid into the circulation $\Rightarrow \uparrow$ VR $\Rightarrow \uparrow$ pulmonary congestion.
- **The condition must be differentiated from bronchial asthma.**

	Cardiac asthma	Bronchial asthma
Age	Usually old	Usually young
Duration of the attack	Usually short	Usually long
Time of the attack	1-2 hours after sleep	Early morning
Frequency	Low frequency	More frequent
Dyspnea	Mainly inspiratory	Mainly expiratory
Expectoration	Frothy & may blood tinged sputum.	Thick sputum
Cardiac examination	Murmurs & gallop	Normal
Chest examination	Crepitations > rhonchi	Rhonchi > crepitations
Circulation time (arm to tongue)	Prolonged	Normal
Morphine	Improvement	contraindicated

Distinguishing cardiac and respiratory causes of dyspnea :

- ECG, exercise ECG, echo, and cardiac catheterization may be required.
- Measurement of B-type natriuretic peptide (BNP) : in patients presenting as an emergency with breathlessness, a serum BNP level <50 ng/l makes cardiac failure very unlikely.

HEMOPTYSIS

Definition :

- Hemoptysis is expectoration of blood originating from the lungs or tracheobronchial tree below the vocal cord.
- **False hemoptysis** : bleeding originating above the vocal cord e.g. mouth, pharynx.

Causes :

I. Respiratory causes :

1. Infections :
 - Acute & chronic bronchitis.
 - Pulmonary TB.
 - Pneumonia.
 - Bronchiectasis.
 - Lung abscess.
2. Tumors :
 - Bronchial carcinoma.
 - Bronchial adenoma.
3. Pulmonary infarction.
4. Iatrogenic, e.g. lung biopsy, bronchoscopy.
5. Connective tissue diseases & Vasculitic syndromes affecting the lung :
Wegener's granulomatosis, SLE, Goodpasture's syndrome.

II. Cardio-vascular causes : (Causes of hemoptysis in a cardiac patient)

1. Pulmonary apoplexy : frank severe hemoptysis occurring mainly in MS due to rupture of bronchial varices. (rare)
2. Chest infection due to lung congestion : MS, LSHF.
3. Myocardial infarction : Dressler syndrome (post infarction syndrome)
4. Severe systemic hypertension.
5. Rupture aortic aneurysm.

III. Systemic causes :

- Hemorrhagic blood diseases : purpura, hemophilia.
- Hemorrhagic fever : small box.
- Heparin & oral anticoagulants.

Most common causes of massive hemoptysis :

Massive hemoptysis (100 - 600 ml blood in 24 hours) is a life-threatening emergency, with a mortality of up to 75 %

- ☠ Bronchiectasis.
- ☠ Bronchial carcinoma.
- ☠ Cavitating lung diseases : TB or fungus (mycetoma) cavity.
- ☠ Mitral stenosis (pulmonary apoplexy).

Diagnostic approach to hemoptysis :**History & physical examination :**

- I. Exclusion of false hemoptysis : by local examination.
- II. Differentiation between hemoptysis & hematemesis. (*see below*)
- III. **Estimation of the amount & course of bleeding** : e.g.
 - Presence of blood clots in the sputum > week is suggestive of lung cancer.
 - Hemoptysis with purulent sputum suggests an infective cause (bronchiectasis).
 - Pink frothy sputum can occur in acute pulmonary edema.
 - Coughing up large amounts of pure blood is rare but potentially life-threatening, the most frequent causes are bronchiectasis, tuberculosis, and lung cancer.
 - Hemoptysis occurring intermittently for a few years, usually in association with a respiratory tract infection occurs in bronchiectasis.

IV. Assessment of the patient for symptoms and signs of underlying diseases : e.g.

- Hemoptysis following the acute onset of pleuritic chest pain and dyspnea : is suggestive of pulmonary embolism.
- A history of previous or coexisting disorders : e.g. HF, SLE.
- Risk factors for COPD & bronchogenic carcinoma particularly smoking.
- Rhonchi (chronic bronchitis, bronchial carcinoma).
- Consolidation (pneumonia).
- Finger clubbing (bronchiectasis or bronchogenic carcinoma).
- Cardiac examination (pulmonary hypertension, MS, HF).
- Skin examination may suggest SLE.

	Hemoptysis	Hematemesis
Complaint	Coughing of blood	Vomiting of blood
Past history	Chest disease	GIT or liver disease
Before the attack	Cough	Nausea, heart burn.
During the attack	Bright red blood. Frothy or mixed with sputum	Dark red (coffee brown) Mixed with food particles.
After the attack	Tinged sputum	Melena
Examination	Crepitations	Chest examination is free.

Investigations :

- Blood tests : CBC, INR, PTT .
- Chest X-ray, CT chest.
- Bronchoscopy.
- Sputum examination.
- Echocardiogram for cardiac lesion.
- Evaluation for PE : spiral CT, ventilation/perfusion scan.
- Autoantibodies : cANCA , ANA (if vasculitis suspected).

Treatment :**I. Mild & moderate hemoptysis :**

- Rest & cough suppressant (avoid expectorants).
- Treatment of the cause.

II. Massive hemoptysis :**1. Airway protection and ventilation :**

- Protection of the non-bleeding lung is vital to maintain adequate gas exchange. This may involve lying on the bleeding side (to prevent blood flowing into the unaffected lung).
- Endotracheal intubation with a double lumen tube and mechanical ventilation.

2. Sedation : diamorphine, diazepam.**3. Cardiovascular support :**

- Central intravenous access.
- Blood transfusion.
- Reverse anticoagulants.

4. Rigid bronchoscopy (with general anesthesia) :

- May allow localization of the site of bleeding.
- Balloon tamponade with a Fogarty catheter : to isolate the affected site with lavage of the other bronchi and trachea from blood.

5. Bronchial artery embolization to embolize bleeding artery usually by gel foam.**6. Surgical resection of the bleeding lobe or lung.****7. Induction of artificial pneumothorax on the affected side to collapse the lung.**

ACUTE RESPIRATORY DISTRESS SYNDROME

(ARDS, Non-cardiogenic pulmonary edema)

Definition :

ARDS is the most severe form of acute lung injury in which there is diffuse alveolar damage (DAD) characterized by ↑ capillary permeability, pulmonary edema & refractory hypoxia.

Causes :

1. Sepsis : (particularly gram –ve septicemia).
2. Smoke inhalation.
3. Aspiration of gastric contents (Mendelson's syndrome)
4. Pneumonia.
5. Pulmonary embolism.
6. Pancreatitis.
7. Burn.
8. Blood transfusion.
9. DIC.
10. Drugs : Prolonged inhalation of oxygen.

Pathophysiology :

ARDS may be caused by lung injury (directly or indirectly via systemic inflammation)
 ⇒ diffuse alveolar damage (DAD) with release of inflammatory mediators (e.g. TNF) that activate neutrophils to become sticky and adhere to the vascular endothelium in pulmonary capillaries then release the contents of their cytoplasmic granules (e.g. proteolytic enzymes) ⇒ increased capillary permeability which in turn causes protein-rich fluid to leak into the alveolar space.

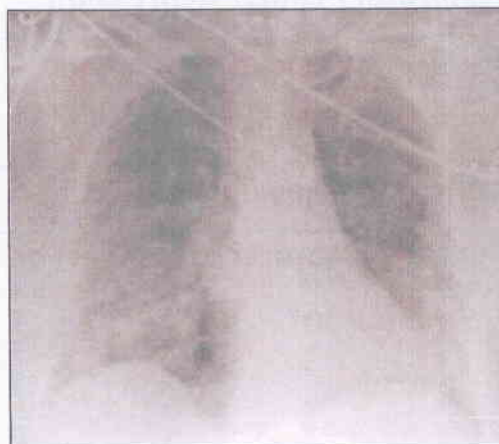
- Cardiogenic pulmonary edema : low permeability, high hydrostatic pressure.
- ARDS : high permeability, low hydrostatic pressure.

Clinical picture :

1. Acute onset of progressive dyspnea & dry cough several hours or days after a predisposing condition.
2. Tachypnea & cyanosis.
3. Tachycardia.
4. Jugular venous pressure : is NOT elevated.
5. Bilateral crepitations.

Diagnosis :

1. Acute onset.
2. $\text{PaO}_2 / \text{FiO}_2$ ratio < 200 mmHg is characteristic of ARDS.
3. Bilateral pulmonary infiltrates on chest X-ray due to pulmonary edema.
4. Absence of evidence of left ventricular failure (normal EF, PCWP < 18 mmHg).

**Treatment :** (mortality rate $> 50\%$)

1. Mechanical ventilation with PEEP (positive end expiratory pressure) to prevent alveolar collapse.
2. Treatment of the cause : Antibiotics for infections.
3. Steroids (?) : are given in the latter stages of ARDS to inhibit fibrosis.
4. Diuretics : not beneficial, ARDS is an inflammatory process, and diuretics don't reduce inflammation.
5. Inhaled nitric oxide : potent pulmonary vasodilator. (not beneficial)
6. Surfactant therapy : has no proven value.

In the 50 years since ARDS was first described, only one therapy has proven effective in improving survival in ARDS : the use of low tidal volume mechanical ventilation.

CHEST COLLECTIONS

Drug induced lung diseases :

Respiratory condition	Drug
Bronchospasm	✗ B blockers. ✗ NSAIDs
Cough	✗ Angiotensin-converting enzyme inhibitors
Respiratory center depression	✗ Sedatives, Opiates.
ARDS	✗ Prolonged inhalation of oxygen. ✗ Opiates, Cocaine, Heroin.
Pulmonary thromboembolism	✗ Estrogen
Pleural effusion	✗ Amiodarone ✗ Methotrexate ✗ Phenytoin ✗ INH ✗ Hydralazine
Interstitial pulmonary fibrosis	✗ Amiodarone. ✗ Methotrexate. ✗ Nitrofurantoin (antibiotic)

Causes of chronic cough with normal Chest X-ray :

- Cough variant asthma or eosinophilic bronchitis.
- Smoking.
- ACEIs.
- GERD.
- Postnasal drip : due to allergic rhinitis or chronic sinusitis.

Causes of cough :

Origin	Common causes	Clinical features
Pharynx	Post-nasal drip	History of chronic rhinitis.
Larynx	Laryngitis, tumor, Whooping cough, croup	Voice or swallowing altered, harsh or painful cough. often associated with stridor.
Trachea	Tracheitis	Retrosternal pain with cough
Bronchi	Bronchitis (acute) and COPD	Dry at first then productive, worse in mornings.
	Asthma	Usually dry, worse at night
	Bronchial carcinoma	Persistent (often with hemoptysis)
Lung parenchyma	Tuberculosis	Productive, often with hemoptysis
	Pneumonia	Dry initially, productive later
	Bronchiectasis	Productive, changes in posture induce sputum production
	Pulmonary edema	Often at night (may be productive of pink, frothy sputum)
	Interstitial fibrosis	Dry, irritant and distressing.
Non respiratory causes	1. GERD. 2. Drug induced : ACEIs. 3. Central causes : brain tumor, cerebral strokes, encephalitis. 4. Reflexes : due to irritation of vagal branches : ○ Meningeal branches : meningitis. ○ Auricular branches : otitis media. ○ Cardiac branches : arrhythmias. ○ Gastric branches : distension of gallbladder.	

Causes of wheezy chest :**Generalized :**

- Bronchial asthma.
- COPD.
- Bronchitis & bronchiolitis.
- Cardiac asthma.
- Churg-Strauss syndrome.
- Sarcoidosis.
- Anaphylaxis.

Localized : (localized bronchial obstruction)

- a. Intra-luminal :
 - FB inhalation.
 - Bronchial carcinoma.
 - Endobronchial TB.
- b. Luminal : bronchial stenosis, stricture.
- c. Extra-luminal : compression by enlarged LN.

Causes of dyspnea in patients with lung cancer :

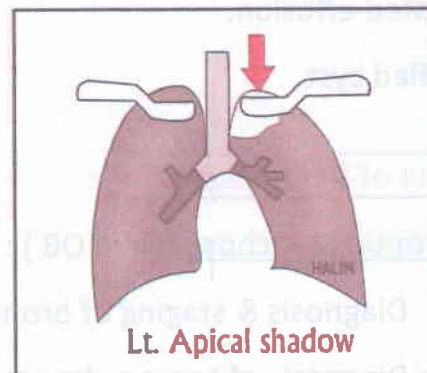
- Pneumonia.
- Underlying chronic lung disease e.g. COPD.
- Lobar collapse.
- Pleural effusion.
- SVCO.
- Upper airway obstruction.
- Pulmonary emboli.
- Lymphangitis carcinomatosa.
- Pericardial effusion.
- Anxiety and panic.

Causes of chest pain in patients with lung cancer :

1. Invasion of the mediastinum, pleura and chest wall.
2. Pancoast tumor : intractable neck, chest & arm pain due to compression and invasion of brachial plexus.
3. Involvement of the esophagus : pain on swallowing.

Causes of apical shadow :

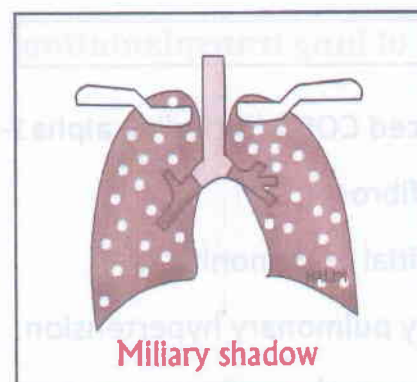
- TB.
- Pancoast tumor.
- Klebsiella pneumonia.
- Pleural thickening.
- Apical collapse, fibrosis.

**Causes of bilateral hilar lymphadenopathy :**

- Sarcoidosis.
- Lymphoma.
- TB & fungal infections.
- Leukemia.

Causes of military shadow :

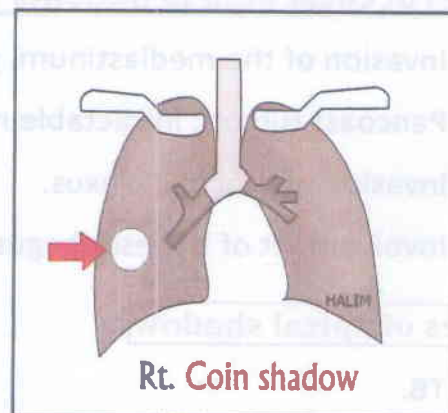
- TB.
- Sarcoidosis.
- Pneumoconiosis (silicosis)
- Metastasis.

**Causes of Honey comb lung :**

1. Bronchiectasis.
2. Sarcoidosis.
3. Tuberculosis.
4. Asbestosis.
5. Idiopathic pulmonary fibrosis.

Causes of coin shadow :

- Bronchogenic carcinoma, solitary metastasis.
- TB , FB (I mean foreign body) ☺
- Pneumonic stage of lung abscess.
- Granuloma.
- Encysted effusion.
- Calcified cyst.

**Indications of bronchoscopy :**

- a) Fiberoptic bronchoscopy (FOB) : done by local anesthesia
 - Diagnosis & staging of bronchial carcinoma.
 - Diagnosis of some pulmonary infections.
 - Therapeutic aspiration of bronchial secretion.
- b) Rigid bronchoscopy : done under general anesthesia
 - Hemoptysis.
 - Removal of foreign body.

Indications of lung transplantation :

1. Advanced COPD (including alpha1-antitrypsin deficiency).
2. Cystic fibrosis.
3. Interstitial pneumonitis.
4. Primary pulmonary hypertension.
5. Eisenmenger's syndrome.
6. Sarcoidosis.
7. Bronchiectasis.

Common causes of acid-base disturbance :

Respiratory acidosis	pH↓	CO ₂ ↑	HCO ₃ ↑	Acute ventilatory failure with: • Acute severe asthma. • severe pneumonia • exacerbation of COPD • thoracic skeletal abnormality, e.g. kyphoscoliosis • neuromuscular disorders, e.g. muscular dystrophy
Respiratory alkalosis	pH↑	CO ₂ ↓	HCO ₃ ↓	<u>Hyperventilation syndrome :</u> • Psychogenic. • Pneumonia, pulmonary embolism. • CNS infections, tumor, stroke. • Drugs : Salicylates. • Metabolic acidosis. • Heart failure, hypotension.
Metabolic acidosis	pH↓	CO ₂ ↓	HCO ₃ ↓	Increased production of organic acids: • diabetic ketoacidosis • acute alcohol poisoning • acute renal failure • lactic acidosis, e.g. shock. Loss of bicarbonate: • renal tubular acidosis • severe diarrhea • Addison's disease
Metabolic alkalosis	pH↑	CO ₂ ↑	HCO ₃ ↑	Loss of acid: • severe vomiting • nasogastric suction Loss of potassium: • excess diuretic therapy • hyperaldosteronism • Cushing's syndrome Excess alkali ingestion: • milk-alkali syndrome

GIVE REASONS : (written & oral)**1. Congested neck vein in COPD.**

- a) Increased intra-thoracic pressure.
- b) Hypoxic Cor-pulmonale.

2. Edema LL in COPD.

- a) Salt & water retention induced by hypoxia of the kidney.
- b) Hypoxic Cor-pulmonale.

3. Puffy eyelids in COPD.

- a) Straining caused by chronic cough.
- b) Hypoxic cor-pulmonale.
- c) Proteinuria.

4. Pulmonary hypertension in COPD.

- a) Hypoxia causes reflex pulmonary arteriolar VC.
- b) Hypoxia causes polycythemia → ↑ pulmonary resistance.
- c) Hypoxia causes peripheral VD → ↑ VR to RV
- d) Compression of the capillaries by the distended alveoli
(hyperinflation)
- e) Reduction of the number of capillaries due to destruction of alveoli.
- f) Fibrosis of blood vessels.

5. RSHF in patients with COPD.

- a) Causes of pulmonary hypertension (see above)
- b) In severe cases, hypercapnia results in respiratory acidosis → myocarditis.

6. Chest pain in COPD.

- a) Muscular pain : due to chronic cough.
- b) Pleurisy complicated pneumonia.
- c) Pneumothorax : due to rupture emphysematous bullae.

7. Irreversible bronchial obstruction in chronic bronchitis.

- a) Mucous gland hypertrophy.
- b) Infiltration of the walls of bronchi with inflammatory cells
(neutrophils, CD8 + T lymphocytes).
- c) Inflammation is followed by scarring & remodeling process that thickens the walls of bronchi.

8. Palpable liver in COPD.

- a) Ptosed liver due to emphysema : not tender.
- b) Congested liver due to RSHF : tender.

9. Elevated hemoglobin with COPD.

Chronic hypoxia → ↑ of BM → secondary polycythemia.

10. Increased serum bicarbonate in COPD.

Retention of sodium bicarbonate by the kidneys as a compensatory mechanism to correct respiratory acidosis.

11. Silent chest in acute severe asthma.

- a) Exhausted respiratory muscles.
- b) Small amount of air passing through the bronchi.

12. Neurological manifestations in bronchial carcinoma.

- a) Brain metastasis : hemiplegia
- b) Mediastinal syndrome : caused by tumor or LN (....)
- c) Thoracic inlet syndrome in pancoast tumor : (....)
- d) Para-malignant syndrome : esp in small cell carcinoma (....)

13. Dyspnea in lung cancer

- Pneumonia.
- Underlying chronic lung disease e.g. COPD.
- Lobar collapse.
- Pleural effusion.
- SVCO.
- Upper airway obstruction.
- Pulmonary emboli.
- Lymphangitis carcinomatosa.
- Pericardial effusion.
- Anxiety and panic.

14. Unequal pupil in bronchial carcinoma.

Compression of subclavian artery : in mediastinal or thoracic inlet syndromes.

15. Chest pain in lung cancer.

- a. Invasion of the mediastinum, pleura and chest wall.
- b. Pancoast tumor : intractable neck, chest & arm pain due to compression and invasion of brachial plexus.
- c. Involvement of the esophagus : pain on swallowing.

16. Cushing's syndrome in bronchogenic carcinoma.

Endocrinal manifestation of para-malignant syndrome : secretion of ACTH by tumor cells esp in small cell carcinoma → ↑ ↑ zona fasciculata of cortex of supra-renal gland to secrete cortisol.

17. Carcinoid syndrome.

- The syndrome includes flushing and diarrhea, and, less frequently, heart failure and bronchoconstriction.
- The carcinoid syndrome occurs in approximately 10% of carcinoid tumors (neuroendocrine tumors, usually appear in the GIT e.g. appendix, small intestine, colon, rectum, and in the lungs)
- It is caused by endogenous secretion of mainly serotonin and kallikrein.
- In most patients, there is an increased urinary excretion of 5-HIAA (5-hydroxy indole acetic acid), a degradation product of serotonin.
- Treatment :
 - Surgical resection of tumor and chemotherapy (doxorubicin)
 - Octreotide (a somatostatin analogue that neutralizes serotonin and decreases urinary 5-HIAA)
 - Methysergide (antiserotonin agent but not used because of serious side effect of retroperitoneal fibrosis)

18. Cardiac abnormalities in carcinoid syndrome

- ➔ About 50% of patients have cardiac abnormalities, caused by serotonin-induced fibrosis of the tricuspid and pulmonary valves.
- ➔ Elevated levels of serotonin have been associated with cardiac failure, due to fibrous deposits on the endocardium.

19. Dyspnea after operation (Post operative pulmonary complications)

- ✓ Aspiration pneumonia.
- ✓ Aspiration lung abscess.
- ✓ ARDS.
- ✓ Pulmonary embolism.
- ✓ Postoperative collapse.
- ✓ Pneumothorax.

20. Rusty sputum

Present in lobar pneumonia due to color of hemoglobin of hemolysed RBCs in stage of red hepatization.

21. Chest pain in pneumonia.

- a) Pleurisy.
- b) Muscular pain due to repeated cough.

22. Non- resolved pneumonia. (Pneumonia lasting for > 2 weeks

inspite of treatment)

- Inadequate treatment.
- Atypical organism.
- Immunocompromised patient.
- Underlying lung disease e.g. lung cancer.
- Pneumonia complicated by empyema or lung abscess.

23. Jaundice in TB.

a) Hepatocellular jaundice :

- Hepatotoxicity : Anti-TB drugs e.g. Rifampicin
- Extrapulmonary affection of the liver.

b) Obstructive jaundice : spread to LN in porta hepatis.

24. Jaundice in bronchogenic carcinoma.

a) Hepatocellular jaundice :

- Hepatotoxicity : side effects of chemotherapy.
- Extrapulmonary affection of the liver.

b) Obstructive jaundice : spread to LN in porta hepatis.

c) Hemolytic jaundice : para- malignant syndrome.

25. Jaundice in pneumonia

a) Hemolytic jaundice : hemolysis of RBCs present in consolidated area.

b) Hepatocellular : Impaired liver function by toxemia.

26. Abscess in right lower lobe of the lung

This is usually primary (inhalation) lung abscess. The inhaled material usually goes to the right lower lobe as the right lower bronchus is wide & in direct continuity with the trachea.

27. Edema LL in bronchiectasis.

- a) Excessive sputum → loss of protein.
- b) Cor-pulmonale.
- c) Renal amyloidosis.

28. Hemorrhagic effusion. P 16

29. Exudative pleural effusion. P 11

30. Clubbing in respiratory diseases.

a) Pale clubbing (due to toxemia) :

- Suppurative lung diseases e.g. bronchiectasis.
- Bronchogenic carcinoma.
- TB.

b) Blue clubbing (due to hypoxia) :

- Interstitial lung diseases.
- Arterio-venous shunts.
- COPD (rare)

31. False -ve tuberculin test.

- Cortisone therapy or Immunocompromised patients.
- Improper technique.
- Pre immune phase (it takes 2–10 weeks after tuberculosis infection for an immune response to PPD to develop)
- fulminant tuberculosis especially military TB.

32. Anemia in TB

- Anemia of chronic disease.
- Toxic inhibition of BM (BM failure)
- Malnutrition.
- Chronic hemoptysis.

MCQ

1- A 55-year-old man with congestive heart failure develops bilateral pleural effusions. Which of the following is the most likely pleural fluid characteristic if thoracentesis is performed?

- a. Pleural fluid LDH 39, LDH ratio 0.2, protein ratio 0.7
- b. Pleural fluid LDH 39, LDH ratio 0.2, protein ratio 0.1**
- c. Pleural fluid LDH 599, LDH ratio 0.9, protein ratio 0.1
- d. Pleural fluid LDH 599, LDH ratio 0.9, protein ratio 0.7

Congestive heart failure is commonly associated with bilateral pleural effusions, which are transudative, as a consequence of alteration of Starling forces. The effusions of heart failure are best managed by treating the heart failure, for example, with diuretics, and typically do not require thoracentesis.

2- A 70-year-old man complains of gradually worsening dyspnea and a persistent cough over the past 3 months but no fevers. He is found to have a right-sided pleural effusion, which is tapped and is grossly bloody. Which of the following is the most likely diagnosis?

- a. Parapneumonic effusion
- b. Malignancy in the pleural space**
- c. Rupture of aortic dissection into the pleural space
- d. Pulmonary embolism with pulmonary infarction

The most common causes of hemorrhagic pleural effusion are malignancy, pulmonary embolism, and tuberculosis. Pulmonary embolism would be suggested by acute onset of dyspnea and pleuritic chest pain rather than this subacute presentation. Similarly, aortic rupture can produce a hemothorax but would have an acute presentation with pain and hemodynamic compromise.

3- A 39-year-old man develops a moderate free-flowing pleural effusion following a left lower lobe pneumonia. Thoracentesis reveals straw-colored fluid with gram-positive diplococci on Gram stain, pH 6.9, glucose 32 mg/dL, and LDH 1890. Which of the following is the best next step?

- a. Send the fluid for culture.
- b. Continue treatment with antibiotics for pneumococcal infection.
- c. Tube thoracostomy to drain the effusion.**
- d. Schedule a follow-up chest x-ray in 2 weeks to document resolution of the effusion.

The positive Gram stain, low pH, low glucose, and markedly elevated LDH all suggest that this parapneumonic effusion is "complicated," that is, it is unlikely to resolve with antibiotic therapy and is likely to produce loculated pockets of pus, which will require surgical intervention. Drainage by serial thoracentesis or tube thoracostomy is essential.

4- A 28 year old man with no significant past medical history presented to ER with an acute onset of pleuritic chest pain and shortness of breath while playing football. On examination, there is decreased expansion of the chest on left side, hyperresonance to percussion and reduced air entry on the left. The most likely diagnosis is

- a) **Left sided pneumothorax**
- b) Left sided pneumonia
- c) Left sided pleural effusion
- d) Left lung fibrosis

5- A 42-year-old woman is being treated with infliximab for rheumatoid arthritis. After 6 months of therapy, she develops persistent fever, weight loss, and night sweats, and tuberculosis is suspected. Which of the following is the most likely location of the tuberculosis?

- a. Middle and lower lung zones
- b. Pleural space
- c. **Apical segment of the upper lung lobes**
- d. Cervical or supraclavicular lymph nodes

Reactivation tuberculosis (in this case, likely triggered by infliximab) usually involves the apical aspects of the lungs. Primary TB infection most often affects the middle and lower lung zones. Lymphadenitis and pleural infection are the most common extrapulmonary sites of TB, but they are less common than pulmonary TB.

6- A 24-year-old man has been treated with isoniazid, rifampin, and pyrazinamide for active pulmonary tuberculosis. After 3 months, he states that he is having numbness and tingling of both feet but no back pain. He denies taking other medications. Which of the following is the most appropriate next step?

- a. CT scan of the lumbar spine.
- b. **Initiate pyridoxine.**
- c. Continue the tuberculosis agents and monitor for further neurologic problems.
- d. Initiate a workup for tuberculosis adenopathy compression on the femoral nerve.

Pyridoxine (vitamin B6) is important for preventing the peripheral neuropathy that can complicate isoniazid therapy. If the numbness were caused by Pott disease, he should have back pain and other neurologic findings, such as lower extremity weakness.

7- A 25-year-old woman is seen in the clinic because her father, who recently emigrated from Aswan, was diagnosed with and has been treated for tuberculosis. She denies a cough and her chest radiograph is normal. A PPD test shows 10 mm of induration. Her only medication is an oral contraceptive. Which of the following is the best next step?

- a. Oral isoniazid and barrier contraception.
- b. Combination therapy including isoniazid, rifampin, and pyrazinamide.
- c. Observation.
- d. Induce three sputum samples.

Because this woman is a household contact of a patient with active TB, she is among the highest risk group: her skin test would be considered positive with 5 mm induration. She has latent TB infection and should be offered treatment to prevent reactivation TB later in life. Oral contraceptives may reduce drug levels, so barrier contraception might be a better option for her.

8- A 25 year old woman is seen in the clinic because her father, who recently came from Aswan, was diagnosed with and has been treated for TB. She denies cough and her chest radiograph is normal. A PPD test done for her shows 15 mm of induration. Which of the following is the best next step?

- a) Combination therapy including isoniazid, rifampin and pyrazinamide.
- b) Observation
- c) Oral isoniazide for nine months
- d) Give rifampicin for six months

9- Which of the following tests is the most important to follow for a patient receiving isoniazid and rifampin for tuberculosis treatment?

- a. Renal function tests
- b. Liver function tests
- c. Slit-lamp examinations
- d. Amylase and lipase tests

Drug-induced hepatitis is a common complication of isoniazid and rifampin.

10- A 45 year old man with diabetes, diagnosed with pulmonary TB who started treatment 2 months ago, presents to you with a week history of pins and needles in his hands and feet with associated numbness. From the list below, which of the following drugs is responsible for the symptoms described by the patient?

- a) Pyrazinamide
- b) Rifampicin
- c) Ethambutol
- d) Isoniazid
- e) None of the above

CLINICAL PEARLS:

- **Reactivation pulmonary tuberculosis most commonly presents radiographically with infiltrates or nodules in the apical and posterior segments of the upper lobes.**
- **Tuberculin skin testing is not a diagnostic test but is a useful screening test for potential contacts of infected persons.**
- **Patients with a positive tuberculin skin test and no clinical or radiographic evidence of active disease are said to have latent tuberculosis infection; they can be treated with isoniazid to reduce their lifetime risk of developing reactivation tuberculosis.**
- **Individuals with active tuberculosis should be initiated on multidrug therapy, such as isoniazid, rifampin, pyrazinamide, and ethambutol.**
- **Pyridoxine (vitamin B6) is usually added to antituberculosis medications to prevent peripheral neuropathy.**

11- You see a 67 year old man who has been referred to the chest clinic following a three month history of weight loss and signs which may suggest a Pancoast tumor. Which of the following symptoms from the list below is not associated with a Pancoast tumor?

- Anhidrosis
- Enophthalmos
- Hoarse voice
- Mydriasis
- Ptosis

Miosis not mydriasis baby. Mydriasis is dilatation of pupil. Pancoast tumor is defined as tumor arising from the lung apex. As the tumor grows it can compress structures such as the brachiocephalic vein, subclavian artery, recurrent laryngeal nerve (causing voice hoarseness), or compression of the sympathetic ganglia resulting in Horner's syndrome (ptosis, miosis, anhidrosis & enophthalmos). **Enophthalmos not exophthalmos, sugar**

12- A 52-year-old man presents with dyspnea, and chest x-ray shows a hilar mass with ipsilateral pleural effusion. Which of the following is the best next step?

- CT scan of the chest, head, and abdomen for cancer staging.
- Pulmonary function testing to evaluate pulmonary reserve to evaluate for pneumonectomy.
- Obtain a specific tissue diagnosis by biopsy of the hilar mass.
- Initiate palliative radiation because the patient is not a candidate for curative resection.

Tissue diagnosis is essential for proper treatment of any malignancy and should always be the first step.

13- A 33-year-old woman who is a nonsmoker has lost 14 kg and has a cough. She is noted to have a lung mass on chest radiograph. Which of the following lung cancers is the most likely cell type?

- a. Squamous cell
- b. Adenocarcinoma
- c. Small cell
- d. Large cell

Ninety percent of patients with lung cancer of all histologic types have a smoking history. The most common form of lung cancer found in nonsmokers, young patients, and women is adenocarcinoma.

14- A 67-year-old long-time smoker with chronic obstructive pulmonary disease presents with 3 days of headaches and plethoric swelling of his face and right arm. Which of the following is the most likely diagnosis?

- A. Angioedema
- B. Hypothyroidism
- C. Superior vena cava syndrome
- D. TB

The patient has features of SVC syndrome, caused by compression of the SVC, almost always by a thoracic malignancy. Urgent diagnosis and treatment are mandatory because of impaired cerebral venous drainage and resultant increased intracranial pressure or possibly fatal intracranial venous thrombosis. Angioedema & hypothyroidism may cause facial swelling, but not the plethora or swelling of the arm.

15- A 64-year-old woman comes to your office complaining of hoarse voice for 4 months. She has not had fever, sore throat, or a cough. On examination, she has expiratory wheezes in her left mid-lung fields. Which of the following is the best next step?

- a. Prescribe antibiotics for bronchitis.
- b. Order a chest x-ray.
- c. Advise gargling with salt-water solution.
- d. Prescribe an albuterol inhaler

This patient has chronic hoarseness and unilateral wheezing. This suggests an intrathoracic mass causing bronchial obstruction and impairment of the recurrent laryngeal nerve, causing vocal cord paralysis. So, an imaging study of the chest is essential.

16- which of the following organisms would typically be found in a patient with atypical community acquired pneumonia?

- a) Hemophilus influenza
- b) Legionella
- c) Pseudomonas
- d) Staph aureus

17- Which of the following are the most likely physical examination findings in a patient with emphysema?

- a. Diffuse expiratory wheezing
- b. Clubbing of the fingers
- c. Bibasilar inspiratory crackles with increased jugular venous pressure (JVP)
- d. Inspiratory stridor
- e. Third heart sound

COPD is characterized by chronic airway obstruction, with most airflow resistance occurring in small airways of the lower respiratory tract, producing expiratory wheezing. Inspiratory stridor would occur with upper airway, usually extrathoracic, obstruction. Clubbing is not generally a feature of COPD and should prompt investigation for another disease process such as a bronchogenic carcinoma. Crackles, elevated JVP, and an S3 are signs of congestive heart failure.

18- Which of the following findings are you most likely to encounter in an 80-year-old woman with severe kyphoscoliosis?

- A. Enlarged overall lung volume (TLC)
- B. Decreased FEV1/FVC
- C. Decreased vital capacity (VC)
- D. Increased vital capacity (VC)
- E. ABG with pH 7.48 and PaCO₂ of 32 mm Hg

Chest wall deformities can lead to chronic hypoventilation with elevated PaCO₂ levels, as well as with recurrent pulmonary infection. The pattern on pulmonary function testing is usually that of a restrictive pattern, with decreased total lung volumes and vital capacity, but with normal FEV1/FVC.

19- Which of the following is the most likely organism to cause a lobar pneumonia in a patient with AIDS?

- a. Pneumocystis jirovecii
- b. Mycobacterium tuberculosis
- c. Histoplasmosis capsulatum
- d. Streptococcus pneumonia

The same organisms that cause community-acquired pneumonia in immunocompromised individuals are causative in HIV patients. Additionally, HIV patients may be more susceptible to encapsulated organisms such as S pneumoniae and H influenzae.

20- A 56-year-old woman admits to a 60-pack-year smoking history. She complains of fatigue and dyspnea with minimal exertion, and a cough that is productive each morning. Which of the following is the most likely finding in this patient?

- A. Normal diffusing capacity of lung for carbon monoxide (DLCO)
- B. Decreased residual volume
- C. Normal to slightly increased forced expiratory volume in first second (FEV1)
- D. Decreased forced expiratory volume in first second/forced vital capacity (FEV1/FVC)
- E. Decreased forced vital capacity (FVC)

This patient likely has COPD, based on the smoking history and symptoms. A decrease in the forced expiratory volume in first second/forced vital capacity ratio is the hallmark of airflow obstruction. The FEV1 is decreased in obstructive, as well as in restrictive, lung disease. The diffusing capacity is typically decreased in COPD as well as intrinsic restrictive lung disease. The DLCO indicates the adequacy of the alveolar-capillary membrane; the residual volume is the volume of air remaining in the lungs after a maximal expiratory effort and is usually increased in COPD due to air trapping.

21- Which of the following therapies is most likely to provide the greatest benefit to a patient with chronic stable emphysema and a resting oxygen saturation of 86%?

- A. Inhaled tiotropium daily
- B. Inhaled albuterol as needed
- C. Oral prednisone daily
- D. Supplemental oxygen used at night
- E. Supplemental oxygen used continuously

For patients with chronic hypoxemia, supplemental oxygen has a significant impact on mortality, with a greater benefit with continuous usage, rather than intermittent or nocturnal-only usage. Bronchodilators such as tiotropium and albuterol improve symptoms and improve FEV1, but offer no mortality benefit. Chronic use of oral corticosteroids should be avoided because of unfavorable side effects such as osteoporosis, glucose intolerance, and gastrointestinal side effects.

22- A patient with known asthma undergoing therapy with inhaled corticosteroid and intermittent (short-acting) β_2 -agonist presents with complaints of nocturnal awakenings secondary to cough and occasional wheezing. This episode occurs three to four times per week. Pulmonary function tests in the past have shown mild obstructive lung disease. Which of the following is the best next step?

- a. Oral steroids
- b. Leukotriene inhibitors
- c. Long-acting β_2 -agonists
- d. Antireflux therapy

Long-acting β_2 -agonists are helpful in this situation. The asthma would be classified as moderate persistent, and the recommended treatment is long acting β_2 -agonists, such as salmeterol, which are particularly helpful with nocturnal symptoms.

23- A 22-year-old woman presents with fatigue, arthralgias, and a dry cough for the past 6 weeks, but no shortness of breath. On physical examination, her lungs are clear to auscultation, and she has bilateral pretibial tender erythematous raised nodules. Which of the following is your best next step?

- a. Chest radiograph
- b. High-resolution CT
- c. Empiric treatment for postnasal drip
- d. Antinuclear antibody
- e. Initiation of antituberculosis therapy

The patient has clinical features suggestive of sarcoidosis given the new cough, arthralgias, and description of erythema nodosum. The initial, most cost-effective study is a chest radiograph. Hilar lymphadenopathy with or without interstitial infiltrates would solidify a diagnosis of sarcoidosis. A high-resolution CT may be ordered if the patient has interstitial lung disease, but it is not the first study of choice. Postnasal drip does not explain the patient's other symptoms. An antinuclear antibody would not necessarily identify the cause of the cough or provide a diagnosis.

24- An obese 50-year-old man with a history of asthma returns with complaints of occasional dyspepsia and nocturnal cough. He wakes up in the morning with a sour taste in his mouth. His current medications include inhaled corticosteroid and a short-acting β_2 -agonist. Which of the following should be your next step?

- a. 24-Hour esophageal pH monitoring
- b. Chest radiograph
- c. Initiation of omeprazole
- d. Short course of oral corticosteroids
- e. Initiation of allergy desensitization

The dyspepsia and the sour taste suggest GERD. Aside from acid suppression, other recommendations include dietary modifications and weight reduction. Twenty-four-hour esophageal pH monitoring is indicated only if the medication does not help.

25- A 65-year-old cigarette smoker with a history of hypertension and mild congestive heart failure presents to the emergency room with worsening cough, fever, and dyspnea at rest. The illness began 1 week ago with fever, muscle aches, abdominal pain, and diarrhea, with nonproductive cough developing later that week and rapidly becoming worse. Therapy for which of the following atypical organisms must be considered in this case?

- a. Chlamydia pneumoniae
- b. Mycoplasma pneumoniae
- c. Legionella pneumophila
- d. Aspergillus fumigatus

Legionella typically presents with myalgias, abdominal pain, diarrhea, and severe pneumonia.

26- 22-year-old woman presents with worsening cough and shortness of breath over 6 weeks, which did not improve with a course of antibiotics or antitussives. Her serum calcium level is found to be 12.5 mg/dL, and a chest x-ray reveals bilateral hilar lymphadenopathy. She has erythema nodosum on her legs. Which of the following is the most likely diagnosis?

- a. Sarcoidosis
- b. Mycoplasma pneumonia
- c. Acute lymphoblastic leukemia
- d. Squamous cell carcinoma of the lung
- e. Pulmonary embolism

Both sarcoidosis and lymphoma can present with cough, dyspnea, and hilar adenopathy on chest x-ray. In approximately 10% of cases, sarcoidosis can cause elevated calcium levels through the production of 1,25-vitamin D that occurs in the macrophages of the granulomas. This can also be seen in granulomas caused by tuberculosis and in lymphoma. Leukemia usually does not present in this manner, although it can cause hypercalcemia. Squamous cell carcinoma of the lung would be unusual in a patient of this age, and the radiographic presentation is atypical.

27- A n 85-year-old nursing home resident with a history of congestive heart failure has dementia such that she requires assistance in all activities of daily life. She has a 3-day history of fever and productive cough. Chest x-ray reveals a right middle lobe consolidation. Which of the following is the most appropriate initial antibiotic choice?

- a. Oral amoxicillin
- b. Intravenous linezolid
- c. Intravenous cefepime
- d. Oral azithromycin

This nursing home resident would be considered to have a nosocomial rather than community-acquired infection, with a higher incidence of gram negative infection. Her age and comorbid medical conditions place her at high risk, requiring hospitalization for intravenous antibiotics such as a thirdgeneration cephalosporin.

28- A 25 year old woman is admitted to ER with severe exacerbation of asthma. On examination her RR is 30. As you feel the peripheral pulse, the volume falls as the patient inspire. Which of the following explains this clinical sign?

- a) Decreased left atrial filling pressures on inspiration
- b) Decreased right atrial filling on inspiration
- c) Increased left atrial pressure on inspiration
- d) Peripheral vasodilatation

As the patient inspires, at high respiratory rates, with air flow compromise due to the narrowing of airways that occurs in acute asthma exacerbation. This results in a sudden increase in negative intrathoracic pressure which causes dilatation of the pulmonary vasculature → pooling of blood in the lungs which results in diminished pulmonary venous return to the left atrium (decreased left atrial filing), hence reducing stroke volume and hence the volume of the pulse falls.

29- A 45 year old woman with unexpected weight loss and shortness of breath presents to you in clinic. On examination, there is reduced air entry and dullness to percussion in the right lung. A pleural aspiration reveals a protein content of > 30 g/L. What is the most likely diagnosis?

- a) **Bronchogenic carcinoma**
- b) Congestive heart failure
- c) Nephrotic syndrome
- d) Liver cirrhosis

30- A 28 year old man has been newly diagnosed with asthma. He has never been admitted to hospital with an asthma exacerbation and experiences symptoms once or twice a week. You discuss the treatment options with him. His PEFR is 85%. Which of the following is the most appropriate first step in treatment?

- a) **Short acting beta 2 agonist inhaler**
- b) Long acting beta 2 agonist inhaler
- c) Low dose steroid inhaler
- d) Leukotriene receptor antagonist
- e) High dose steroid inhaler

This case is mild intermittent asthma

31- A 46 year old man has presented to ER with acute onset of shortness of breath with high clinical suspicion of pulmonary embolism. Which of the following ECG changes are classically seen?

- a) Inverted T waves in lead I, tall & flat T waves in lead III
- b) **Deep S waves in lead I, pathological Q waves in lead III, and inverted T waves in lead III**
- c) No changes in lead I, deep S waves in lead III
- d) Deep S waves in lead I with no changes in lead III

32- Which of the following is not a cause of bronchiectasis?

- a) Kartagener syndrome
- b) Cystic fibrosis
- c) **Left ventricular failure**
- d) Ulcerative colitis
- e) Allergic bronchopulmonary aspergillosis

33- Which is not a cause of finger clubbing?

- a) Empyema
- b) Bronchogenic carcinoma
- c) **COPD**
- d) Cystic fibrosis
- e) Mesothelioma

34- You are asked to request imaging for a patient with a suspected pneumothorax who you have just examined. Which of the following would be the first step image modality?

- a) CT chest
- b) US chest
- c) V/Q scan
- d) **Chest X ray**

35- A 50 year old man with no past medical history, presents with a four month history of dry cough and shortness of breath on exertion. The patient is referred to the chest clinic after performing blood tests which revealed high ESR and serum ACE level. Chest X ray revealed bilateral hilar lymphadenopathy. What is the most likely diagnosis?

- a) Idiopathic pulmonary fibrosis
- b) Bronchogenic carcinoma
- c) **Sarcoidosis**
- d) Bronchial asthma

36- A 69 year old man presents with dyspnea, cyanosis and finger clubbing. His chest X ray shows bilateral lower zone reticulo-nodular shadowing. Which is the most likely diagnosis?

- a) Bronchiectasis
- b) **Pulmonary fibrosis**
- c) Bronchogenic carcinoma
- d) COPD
- e) Bronchitis

Remember that pulmonary fibrosis usually starts at the bases and spreads superiorly to the upper zones of the lung.

37- Which of the following types of cancer is most commonly associated with myasthenia gravis?

- a. Small cell lung cancer
- b. Non-small cell lung cancer
- c. Mesothelioma
- d. **Thymoma**

38- Which of the following, from the pleural aspirate analysis, would typically be found in a patient with an empyema?

- a) pH >7.2, ↑LDH, ↑glucose
- b) pH <7.2, ↑LDH, ↑glucose
- c) pH >7.2, ↓LDH, ↓glucose
- d) **pH <7.2, ↑LDH, ↓glucose**

39- You are told that a patient in clinic has been diagnosed with cystic fibrosis using the sodium chloride (NaCl) sweat test. Which of the following results would indicate a positive diagnosis of cystic fibrosis?

- a) NaCl < 40 mmol/L
- b) NaCl > 60 mmol/L
- c) NaCl < 60 mmol/L
- d) NaCl > 50 mmol/L

- Cystic fibrosis is an autosomal recessive disorder leads to increased chloride secretion and Na absorption resulting in mucus accumulation leading to chronic infections & bronchiectasis.
- CP :
 - Respiratory : cough, recurrent infections, bronchiectasis, pneumothorax...
 - GIT : pancreatic dysfunction (DM, malabsorption), distal intestinal obstruction, gallstones, infertility, nasal polyps and hypertrophic pulmonary osteoarthropathy.
- Diagnosis :
 - NaCl sweat test : > 60 mmol/L
 - Genetic testing
 - Fecal elastase can be measured to assess exocrine pancreatic dysfunction.
- Treatment :
 - Treatment of bronchiectasis
 - GIT : pancreatic enzyme replacement, fat soluble vitamins, UDCA.

40- Which of the following organisms responsible for causing chronic pneumonia is most commonly found in patients with longstanding cystic fibrosis?

- a) L. pneumophila
- b) S. pneumonia
- c) Pseudomonas aeruginosa
- d) H. influenza

41- Which of the following carcinomas of the lung is highly associated with exposure to asbestoses?

- a) Adenocarcinoma
- b) Small cell carcinoma
- c) Squamous cell carcinoma
- d) Malignant mesothelioma

42- Which of the following drugs is most likely to cause pulmonary fibrosis?

- a) Amlodipine
- b) Aspirin
- c) Amiodarone
- d) Alendronate

43- which of the following does not fall under the category of hypersensitivity pneumonitis?

- a) Coal worker's lung
- b) Pigeon fancier's lung
- c) Mushroom picker's lung
- d) Farmer's lung
- e) Malt worker's lung

- Hypersensitivity pneumonitis (extrinsic allergic alveolitis) is a rare immune system disorder that affects the lungs. It is an inflammation of the alveoli within the lung caused by hypersensitivity to inhaled organic dusts such as fungal spores or avian proteins. Sufferers are commonly exposed to the dust by their occupation or hobbies.
- Hypersensitivity pneumonitis may also be called many different names, based on the provoking antigen. These include:
 - Bird fancier's lung : Also called pigeon breeder's lung.
 - Farmer's lung : is a hypersensitivity pneumonitis induced by the inhalation of biologic dusts coming from hay dust or mold spores or any other agricultural products.
 - Malt worker's lung, Coffee worker's lung, Mushroom worker's lung, ...

44- Which of the following drugs would be the most appropriate to treat pulmonary Aspergillus spp. Infection?

- a) Amoxycillin.
- b) Erythromycin
- c) Amphotericin B
- d) Flucloxacillin

45- Patient received salbutamol, what is expected regarding electrolytes?

- a) Hypermagnesemia
- b) Hypernatremia
- c) Hypokalemia
- d) Hyperkalemia

46- 25 year old man has sudden onset of chest pain on the right side and dyspnea. His trachea is deviated to the left. All of the following would be anticipated except

- a) Absence of rales
- b) Absence of rhonchi
- c) Hyperresonance over the right chest
- d) Distant breath sounds on the right
- e) **Pleural friction rub on the left**

47- A 62-year-old man with limited-stage small cell lung cancer and proximal muscular weakness is most likely to have which of the following conditions?

- a. SIADH
- b. Myasthenia gravis
- c. Cerebellar degeneration
- d. **Eaton-Lambert syndrome**

48- Bilateral pleural effusion is commonly seen in all except:

- a. SLE
- b. Nephrotic syndrome
- c. Pulmonary tuberculosis
- d. **Congestive cardiac failure**

49- In examining the pleural fluid the following characteristics imply an exudative effusion except:

- a) Pleural/serum protein ratio greater than 0.5
- b) **Pleural pH of 7.40**
- c) Pleural/serum LDH ratio of greater than 0.6
- d) WBC content of 6000

50- Pleural effusion associated with pulmonary embolism can be:

- a) An exudate
- b) A transudate
- c) Bloody
- d) **All of the above**

51- As regard to Pleural effusion in rheumatoid – collagen vascular disease, all are true except

- a. Often associated with onset of joint symptoms
- b. Has a low pH and glucose
- c. **Often bilateral**
- d. Empyema can occur in this setting

Rheumatoid pleural effusion :

- Usually unilateral (75%).
- Effusion usually occurs after onset of arthritis and subcutaneous nodules.
- Pleural fluid characteristics similar to empyema (low glucose, pH < 7.20, LDH > 600 iu / dl). Beware because empyema is commonly complicates rheumatoid effusions.

52- Tobacco use is associated with the following cancers except

- a) Bladder
- b) Liver
- c) Pancreas
- d) Pharynx
- e) Colorectal

53- In a patient with airways obstruction and sacular bronchiectasis on chest CT and eosinophilia a primary diagnosis to consider is:

- a. Cystic Fibrosis
- b. Histoplasmosis
- c. Bronchopulmonary aspergillosis
- d. Tuberculosis

54- A 60 year old man has had cough and sputum for over 15 years. Now he complains that his sputum is blood tinged, particularly when he first awakens in the morning. His chest X-rays show "tram-lines" at both lung bases. These findings suggest:

- a. Carcinoma of the lung
- b. Bronchiectasis
- c. Interstitial lung disease
- d. Heart failure

55- A cough made worse in recumbent position suggests:

- a. Pulmonary embolism
- b. Asthma
- c. Gastroesophageal reflux
- d. Subdiaphragmatic abscess

56- Most common cause of a chronic slightly productive cough in the adult population is:

- a. Asthma
- b. Chronic bronchial inflammation
- c. Heart failure
- d. None of the above

57- A 40 year old woman is seen in the office complaining of shortness of breath in climbing a flight of stairs, which has been progressive over the past four months. Her physical examination is unremarkable. Her chest X-rays show bilateral hilar adenopathy, with a mild diffuse infiltrate in the lung fields. What is the most likely diagnosis:

- a. Interstitial pulmonary fibrosis (IPF)
- b. Sarcoidosis
- c. Wegener's granulomatosis
- d. Asbestosis

58- In interstitial lung diseases, lung function tests most often show:

- a. Reduced carbon monoxide diffusing capacity (DLCO)
- b. Increased total lung capacity (TLC)
- c. Airflow obstruction
- d. Elevated arterial PCO₂

59- A 60 year old man, former smoker, was found to have an 8 mm mass lesion in the left upper lobe on chest X-ray, during a routine evaluation in his doctor's office. He is totally asymptomatic. There are no previous chest films. To make a diagnosis, what is the next step?

- a. Repeat chest films in six months
- b. Bronchoscopy with transbronchial biopsy
- c. Fine needle CT guided aspiration of the lesion
- d. Sputum cytology

60- A 64 year old man is referred from the cardiology department who question whether his dyspnea is secondary to pulmonary rather than cardiac causes. He has a history of difficult to control atrial fibrillation but this has settled with new medication. A chest x-ray shows an increased interstitial pattern in the lung bases. On examination the patient is in sinus rhythm, has no clubbing, no raised jugular venous pulse, no S3 but has inspiratory crackles in both lung bases. Pulmonary function tests show a restrictive pattern. What is the most likely cause of his dyspnea?

- a) Chronic obstructive lung disease
- b) Idiopathic pulmonary fibrosis
- c) Pulmonary embolic disease
- d) Drug induced pulmonary fibrosis

With regards idiopathic pulmonary fibrosis the symptoms, chest x-ray findings and pulmonary function tests are suggestive but the patient does not have clubbing which is somewhat against this diagnosis. With regards pulmonary embolic disease the chest x-ray findings do not support this and the most striking pulmonary function test findings in this situation would be a decreased diffusing capacity. This patient was reported to have had atrial fibrillation but is now in sinus rhythm due to a new medication which in this case was amiodorone, a classic cause of drug-induced pulmonary fibrosis.

61- In adult respiratory distress syndrome (ARDS) the following findings are present except:

- a. Cyanosis
- b. Tachypnea
- c. Infiltrates on chest X-ray
- d. Elevated pulmonary capillary wedge pressure

62- A 60 year old man who has worked with asbestos for 10 years, stopping over 20 years ago, presents with dyspnea and a chest x-ray which shows pleural plaques. His pulmonary function tests show an obstructive pattern with no significant bronchodilator response. What is the most likely cause of his dyspnea?

- a) Asbestosis
- b) Mesothelioma
- c) Chronic obstructive lung disease
- d) Asthma
- e) Silicosis

Asbestosis is unlikely given that the chest x-ray only shows pleural plaques and the pulmonary function test abnormalities are of an obstructive type. There is no evidence of mesothelioma either clinically or on x-ray. There is no history of the exposures which would lead to silicosis and again the chest x-ray is not supportive. The pleural plaques are indicative of asbestos exposure but nothing else. The pulmonary function tests are of an obstructive type with no bronchodilator effect suggesting chronic obstructive lung disease as the most obvious cause of this patient's dyspnea.

63- In a subject with an arterial PCO₂ of 30 mm Hg, you would consider all of the following in the differential diagnosis EXCEPT

- a. Acute airway obstruction
- b. Interstitial lung disease
- c. Pulmonary embolism
- d. Diabetic ketoacidosis

64- All of the following are indicators of severe pneumonia EXCEPT

- a) Altered mental status
- b) PaO₂ < 90mmHg
- c) Respiratory rate > 30/min
- d) Blood pressure < 90/60mmHg
- e) Chest X-ray shows bilateral infiltration, multi-lobe infiltration and the infiltrations enlarge more than 50% within 48h

65- All of the following are complications of lobar pneumonia except

- a) Lung abscess
- b) Amyloidosis
- c) **Suppurative arthritis**
- d) Infective endocarditis

66- Most common site of metastatic disease is

- a) Bone
- b) Brain
- c) **Liver**
- d) Lung

67- All of the following are non metastatic complications of malignancy except

- a) Cushing syndrome
- b) **Cerebral cortical degeneration**
- c) Cerebellar degeneration
- d) Polymyositis

68- A high amylase level in pleural fluid suggestive of

- a) Tuberculosis
- b) **Malignancy**
- c) Rheumatoid arthritis
- d) Pulmonary infarction

69- The diffusion capacity of the lung (DLCO) is not decreased in the following conditions

- a) Interstitial lung disease
- b) **Good pasture syndrome**
- c) Emphysema
- d) Primary pulmonary hypertension

70- In a case of humoral immunodeficiency. Which of the following infections is suspected?

- a) Giardiasis
- b) **Pneumocystis carinii pneumonia**
- c) Recurrent sinusitis
- d) Recurrent subcutaneous abscess

71- Which of the following drugs is not useful in the treatment of acute bronchial asthma?

- a) Ipratropium
- b) Salbutamol
- c) **Montelukast**
- d) Hydrocortisone

72- Which of the following is not correct regarding sarcoidosis?

- a) Often cavitates
- b) Spontaneous remission is usual
- c) Bilateral hilar lymphadenopathy
- d) Tuberculin test is negative

73- Which of the following is not a cause of pulmonary hypertension?

- a) Hyperventilation
- b) Obesity
- c) High altitude
- d) Phenfluramine

Phenfluramine is an appetite suppressant which was used to treat obesity and is now no longer marketed

74- After TB has been transmitted, how long does it take for the body's immune system to be able to react to tuberculin?

- a. 48 to 72 hours
- b. 7 to 10 days
- c. 2 to 8 weeks
- d. 6 months or more

75- Smoking is not a risk factor of

- a) Small cell carcinoma
- b) Emphysema
- c) Respiratory bronchiolitis
- d) Bronchiolitis obliterans organizing pneumonia

- Bronchiolitis obliterans with organizing pneumonia (BOOP), also called Cryptogenic Organizing Pneumonia (COP), is a rare lung condition affecting the bronchioles, alveoli and the walls of small bronchi.
- It is often a complication of an existing chronic inflammatory disease such as rheumatoid arthritis, dermatomyositis, or it can be a side effect of certain medications such as amiodarone.
- In most cases, gradual onset of shortness of breath and dry cough are symptoms of BOOP/COP.
- Oral steroids, such as prednisone, are the most common treatment for BOOP/COP.

76- A low protein content is characteristic of pleural effusions associated with :

- a) TB.
- b) Cirrhosis.
- c) Bronchogenic carcinoma.
- d) Rheumatoid diseases.

77- Which of the following manifestations is typical of Kartagener's syndrome?

- a. Intestinal obstruction
- b. Dextrocardia
- c. Steatorrhea
- d. Infertility

78- Hypercapnia is a typical feature of :

- a) Pulmonary embolism.
- b) Salicylate intoxication.
- c) Pulmonary fibrosis.
- d) Severe chronic bronchitis

79- In pneumonia, the following features are classically associated with the specific organisms EXCEPT :

- a) Erythema nodosum and Mycoplasma pneumonia.
- b) Hyponatremia and Legionella pneumonia.
- c) Abscess formation and Staphylococcus aureus.
- d) Hemolytic anemia and Streptococcus pneumonia.

80- In lobar pneumonia which of the following is true in arterial blood :

- a) Decreased P_{O_2} , increased P_{CO_2}
- b) Decreased P_{O_2} , Decreased P_{CO_2} .
- c) Decreased P_{O_2} and normal P_{CO_2} .
- d) Normal P_{O_2} , increased P_{CO_2} .

81- Which is NOT a part of Kartagener syndrome :

- a) Dextrocardia.
- b) Sinusitis.
- c) Impotence.
- d) Bronchiectasis.

82- Which is correct in type 2 respiratory failure :

- a) Decreased P_{O_2} , increased PCO_2
- b) Decreased P_{O_2} , Decreased P_{CO_2} .
- c) Decreased P_{O_2} and normal P_{CO_2} .
- d) Normal P_{O_2} , increased P_{CO_2} .

83- In pleural effusion, an impaired transport of glucose into the pleural space is found in :

- a) TB
- b) Myxedema.
- c) Liver cirrhosis.
- d) Rheumatoid arthritis.

84- Bronchial breath sound is found in all EXCEPT

- a) Collapse with patent bronchus.
- b) bronchial asthma.
- c) superficial, big, cavity with patent bronchus.
- d) bronchopleural fistula.

85- A 43 year old man consult you as he is producing a cupful of foul purulent sputum every day. Examination reveals digital clubbing and coarse crackles at the left base. What is the most likely diagnosis ?

- a) Bronchiectasis.
- b) Acute lung abscess.
- c) Bronchoalveolar cell carcinoma.
- d) Sarcoidosis.

86- Clubbing is present in all EXCEPT :

- a) Fibrosing alveolitis.
- b) Cystic fibrosis.
- c) Emphysema.
- d) Bronchiectasis.

87- Crepitations not influenced by coughing are found in :

- a) Acute pulmonary edema.
- b) Pneumonia.
- c) Fibrosing alveolitis.
- d) Lung abscess.

88- Which of the following drugs is NOT used in acute asthma :

- a) Zafirlukast.
- b) Terbutaline.
- c) Corticosteroids.
- d) Ipratropium bromide.

89- Which of the following occupations is associated with new onset asthma?

- a) Paint sprayer.
- b) Insulation installer.
- c) Typist.
- d) Truck driver.

Isocyanates are examples of low molecular weight substances that induce asthma. These compounds are found in spray paint & plastics. Insulation installer may be exposed to asbestose, this would result in fibrosis rather than bronchospasm.

90- Which of the following is the most common malignancy associated with asbestos exposure ?

- a) Pleural mesothelioma.
- b) Non-Hodgkin lymphoma.
- c) **Bronchogenic carcinoma.**
- d) Fibrosarcoma.

Although malignant mesothelioma is usually associated with a history of exposure to asbestos, it is a relatively uncommon malignancy. In contrast, the risk of bronchogenic carcinoma increases markedly with asbestos exposure (2-3 fold)

91- A pleural aspirate with diminished glucose concentration, excess lymphocytes, high specific gravity is characteristic of :

- a) **Tuberculous effusion.**
- b) Pneumococcal pneumonia.
- c) Asbestosis.
- d) Malignant lymphoma.

- The exudate, due to pneumococcal pneumonia has the same picture but contains instead of lymphocytes, polymorphonuclear leukocytes.

- The exudate due to asbestosis is due to development of mesothelioma and is hemorrhagic & doesn't decrease the sugar content of the aspirate.

- In malignant lymphoma, the aspirate is the same as TB but the glucose level is not affected.

92- A patient with low grade fever and weight loss has decreased movement on the right side of the chest with decreased fremitus, dullness to percussion, and decreased breath sounds all on the right. The trachea is deviated to the left. The most likely diagnosis is:

- a) Pneumothorax.
- b) Pneumonia.
- c) **Pleural effusion.**
- d) Atelectasis.

93- Which is false regarding transudative pleural effusion :

- a) Protein < 3.0 g/100ml.
- b) Pleural fluid/serum LDH ratio < 0.6
- c) **PH < 7.2**
- d) Specific gravity < 1016

94- Which is example of exudative pleural effusion :

- a) Nephrotic syndrome.
- b) Constrictive pericarditis.
- c) SVC syndrome.
- d) **Rheumatoid arthritis.**

95- Commonest cause of hypertrophic osteoarthropathy is :

- a) Fallot's tetralogy.
- b) Bronchiectasis.
- c) Mesothelioma.
- d) **Bronchogenic carcinoma.**

96- Which of the following drugs may produce pleural effusion :

- a) Losartan.
- b) Miltefosine.
- c) **Amiodarone.**
- d) Propranolol.

97- Pink, frothy, and profuse sputum is seen in :

- a) Pneumoconiosis.
- b) Lobar pneumonia.
- c) **Acute pulmonary edema.**
- d) Aspergilloma.

98- A patient with hemoptysis and having depressed bridge of the nose is diagnostic of :

- a) Rickets.
- b) **Wegner's granulomatosis.**
- c) Congenital syphilis.
- d) Rhinocerebral mucormycosis.

99- Which of the following is not a paraneoplastic syndrome in bronchogenic carcinoma :

- a) Cachexia.
- b) **Hemoptysis.**
- c) Polymyositis.
- d) SIADH

100- Which does not belong to the triad of symptomatic bronchial asthma :

- a) **Chest pain.**
- b) Dyspnea.
- c) Wheeze.
- d) Cough.

101- Caplan's syndrome is coal worker's pneumoconiosis associated with :

- a) SLE
- b) Scleroderma.
- c) **Rheumatoid arthritis.**
- d) Ankylosing spondylitis.

102- Viral pneumonia may have :

- a) Signs of consolidation in chest.
- b) **Splenomegaly**
- c) High WBC count
- d) Foul-smelling expectoration.

103- Which is not a bedside feature of fibrosing alveolitis

- a) Orthopnea
- b) **Anemia**
- c) Clubbing
- d) Crepitations

104- Chronic respiratory failure is not seen in

- a) Diffuse interstitial fibrosis
- b) Emphysema
- c) **Pneumothorax**
- d) Chronic bronchitis

105- Commonest middle mediastinal mass is

- a) Lymphoma
- b) **Aortic aneurysm**
- c) Bronchogenic cyst
- d) Thymoma

106- Commonest cause of superior mediastinal syndrome is :

- a) Lymphoma.
- b) Thymoma.
- c) **Bronchogenic carcinoma.**
- d) Retrosternal goiter.

107- Which is false regarding Pickwickian syndrome

- a) Marked obesity
- b) **Hyperventilation**
- c) Somnolence
- d) Right sided heart failure

108- The commonest benign pulmonary neoplasm is

- a) Lipoma
- b) **Adenoma**
- c) Fibroma
- d) Hamartoma

109- Investigation of highest diagnostic efficacy in acute pulmonary thromboembolism is

- a) ECG
- b) **Ventilation/perfusion lung scan**
- c) Spiral CT
- d) Arterial blood gases.

110- High amylase in pleural fluid is found in all EXCEPT

- a) Esophageal rupture
- b) Bronchogenic carcinoma
- c) **Sarcoidosis**
- d) Acute pancreatitis

111- Pure oxygen therapy may produce all of the following EXCEPT

- a) Acute lung injury
- b) Respiratory depression
- c) **Fibrosis of the lung**
- d) Consolidation of the lung

112- Upper border of liver dullness is elevated in all EXCEPT

- a) Ascites
- b) Right subdiaphragmatic abscess
- c) **Right pneumothorax**
- d) Right pleural effusion.

113- Commonest cause of respiratory failure is

- a) Emphysema
- b) Fibrosing alveolitis.
- c) Bronchial asthma.
- d) **Chronic bronchitis.**

114- Acute lung injury (ARDS) should be differentiated from :

- a) **Acute LVF**
- b) Congestive cardiac failure.
- c) Acute severe asthma.
- d) Spontaneous pneumothorax.

115- All are features of hypercapnia EXCEPT

- a) Capillary pulsation
- b) **Central cyanosis.**
- c) Papilledema
- d) Asterixis.

116- Classic dermatological manifestation of chronic sarcoidosis is :

- a) Erythema nodosum.
- b) Maculopapular rash
- c) **Lupus pernio**
- d) Subcutaneous nodules.

117- The most reliable symptom of acute pulmonary thromboembolism is

- a) Chest pain
- b) Hemoptysis.
- c) **Breathlessness**
- d) Syncope

119- Pulmonary fibrosis is not produced by :

- a) Tuberculosis.
- b) **Cor pulmonale.**
- c) Progressive systemic sclerosis.
- d) Rheumatoid arthritis.

120- Cranial nerve most commonly affected in sarcoidosis is :

- a) **VII**
- b) II
- c) V
- d) X

121- Commonest cause of death in sarcoidosis is :

- a) **Cor pulmonale.**
- b) Pneumonia.
- c) Nephrocalcinosis.
- d) Neurosarcoidosis.

123- Reactivation of pulmonary tuberculosis is due to :

- a) Malnutrition.
- b) Low perfusion.
- c) **High ventilation.**
- d) Low PaO₂.

124- Commonest sign of aspiration pneumonia is :

- a) Stridor.
- b) **Tachypnea.**
- c) Central cyanosis.
- d) Crepitations.

125- The dose of which antituberculous drug need not to be reduced in severe renal failure

- a) **Rifampicin.**
- b) INH.
- c) Pyrazinamide.
- d) Streptomycin.

126- Bronchial adenoma most commonly present as :

- a) Cough.
- b) Stridor.
- c) **Recurrent hemoptysis.**
- d) Chest pain.

127- Bradypnea is associated with :

- a) **Narcotic overdose.**
- b) Acidosis.
- c) Pneumonia.
- d) Acute lung injury.

128- Primary spontaneous pneumothorax is associated with :

- a) Tall & thin individuals.
- b) Non-smokers.
- c) Exercise.
- d) COPD.

129- Predominantly left sided pleural effusion is seen in :

- a) Congestive heart failure.
- b) Amebic liver abscess.
- c) Esophageal rupture.
- d) Liver cirrhosis.

130- Which of the anti-tuberculous drugs should be totally avoided in pregnancy :

- a) INH.
- b) Rifampicin.
- c) Ethambutol.
- d) Streptomycin.

131- The most common organism causing pneumonia during mechanical ventilation in the first 4 days of hospitalization is :

- a) Staph. aureus.
- b) Streptococcus pneumonia.
- c) Gram -ve bacilli.
- d) Hemophilus influenza.

132- Which of the following is NOT responsible for development of interstitial lung disease :

- a) Carbamazepine.
- b) Methotrexate.
- c) Amiodarone.
- d) Carbimazole.

133- On examination of the chest of a patient with a unilateral tension pneumothorax, which of the following signs is present?

- a) Chest wall movements are decreased on both sides.
- b) The mediastinum is pulled towards the affected side.
- c) Breath sound may be decreased or absent on the affected side.
- d) Tactile vocal fremitus will be increased on the affected side.

134- Which of the following is a typical manifestation of chronic hyperventilation?

- a) Hypoxemia
- b) Hyperphosphatemia
- c) Tetany
- d) Clubbing

135- A 65-year-old man presents with progressive shortness of breath with a history of heavy tobacco use. Breath sounds are absent on the left side of the chest. Percussion of the left chest reveals dullness. While you place your hand on the left side of the chest and have the patient say "ninety nine," no tingling is appreciated in the hand. The trachea appears to be deviated toward the left. Which of the following diagnoses is most likely?

- a) Pneumonia
- b) Bronchial obstruction**
- c) Pleural effusion
- d) Pneumothorax

This case is left lung collapse produced by an obstructed bronchus. A possible cause of obstruction and atelectasis of a large amount of left lung tissue could be obstruction of a major bronchus by carcinoma of the lung, especially in an older patient who is a heavy smoker.

136- Which one of the following disorders characteristically produces type I respiratory failure ?

- a) Kyphoscoliosis.
- b) Guillan-Barre polyneuropathy.
- c) ARDS**
- d) Inhaled foreign body in a major airway

137- All of the following are causes of an elevated hemidiaphragm EXCEPT :

- a) Laryngeal nerve paralysis.**
- b) Surgical lobectomy.
- c) Subphrenic abscess.
- d) Pulmonary collapse.

phrenic nerve paralysis not laryngeal nerve, baby

138- A 49 year old man with acute pancreatitis develops severe shortness of breath 15 minutes after undergoing placement of a catheter in his subclavian vein. His blood pressure is 100/60 mmHg, pulse is 124/min, and RR is 50/min. he is cyanotic and in obvious distress. His neck veins are distended and trachea deviates to the left. Breath sounds are diminished on the right side of his chest. Which of the following is the most appropriate next step in management?

- a) Chest X ray
- b) Endotracheal intubation
- c) Needle thoracotomy in the second right intercostal space**
- d) Removal of the catheter

Notice that closed traumatic pneumothorax is a significant risk associated with catheterization of the subclavian veins due to puncture of the apex of the lung.

The appropriate immediate treatment is needle thoracotomy at the second right intercostal space followed by chest tube insertion at the right fifth intercostal space.

139- Concerning respiratory failure, Which of the following statements is true ?

- a) PaCO₂ is elevated in all types of respiratory failure.
- b) The commonest cause of type II respiratory failure is pneumonia.
- c) Pulsus paradoxus is a sign commonly associated with respiratory failure.
- d) It always presents with dyspnea.

140- A 48 year old man with long history of smoking presents to ER with difficulty breathing for the past 2 days. His temperature is 38, blood pressure is 120/70 mmHg, and pulse is 103/min. dullness to percussion and decreased breath sounds are noted over the right lower lung. Chest X ray reveals right sided pleural effusion. The following results are obtained :

- Pleural fluid : PH : 7.18, glucose : 40 mg/dL, protein : 3.8g/L, LDH : 220 IU/L
- Serum : Protein : 7 g/dL, LDH : 320 IU/L

Which of the following is most likely etiology of the effusion?

- a) A transudate of infectious etiology
- b) A transudate of noninfectious etiology
- c) An exudate of infectious etiology
- d) An exudate of inflammatory etiology

141- A 40 year old male, presents with a long history of productive cough and breathlessness. He had complained of halitosis and exacerbation of productive sputum, chest pain and hemoptysis. Examination revealed bilateral inspiratory crackles. Which of the following treatments is likely to decrease the frequency of his exacerbation?

- a) Cyclic antibiotic therapy
- b) Inhaled corticosteroid
- c) Nebulized bronchodilator
- d) Postural drainage
- e) Surgical resection

The case is bronchiectasis, baby.

142- Unilateral consolidation on chest X-ray can be caused by all EXCEPT

- a) Pneumonia
- b) Pulmonary infarction
- c) Pulmonary edema
- d) Pulmonary hemorrhage

143 - 146 :

- a) Chest x ray.
- b) arterial blood gas.
- c) CT chest.
- d) V/Q scan.
- e) Peak expiratory flow rate.
- f) FBC.

Which is the most appropriate investigation for each of the scenarios below?

143- A 17 year-old girl has been admitted with acute onset shortness of breath believed by her GP to be a deterioration in her normally well controlled asthma. She has suffered with asthma since the age of 5 years & is normally well controlled, she has never had any hospital admissions. She usually takes regular salbutamol and beclomethasone. **E**

144- A 27-year-old patient with a history of Marfan's disease presents to emergency with new onset shortness of breath. He has not had any recent illness and has not been exerting himself or playing any sports in the past couple of days. He is not complaining of cough but has noticed a small amount of right sided chest pain since the onset of the shortness of breath. **A**

145- A 51-year-old lady has recently returned from holiday in Alex. Since her return she has noticed a minor pleuritic chest pain, which she thought would resolve with time. 2 days on, the pain is worsening and she has developed shortness of breath. On examination her saturation on room air is 89% , her chest is clear with good air entry & she has no swelling in her calves. D-dimer test is positive and chest X-ray normal. **D**

146- A 41-year-old man is referred by his GP to the respiratory clinic for investigations of his worsening dyspnea & dry cough. He has no past respiratory history & his GP is concerned about finger clubbing, which he has noticed on routine examination. On auscultation of his chest he has noticed fine end inspiratory crepitations and chest X-ray shows a ground glass appearance. **C**

حقوق الطبع و النشر محفوظة للمؤلف

©All rights reserved. This book is protected by copyright. No part of it may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical, photocopying, recording or otherwise, without written permission from the author